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OCULAR INJURIES: THEIR TREATMENT *

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One's conception of the term eye injuries is usually based on the character of the injuries received in the locality where one practices. I shall describe here some of the cases occurring in the industrial locality where I practice.

The most frequent injury that I am called on to treat is a foreign body in the cornea, comprising at least 60 per cent of all cases. In an analysis of 4,541 ocular injuries occurring in industry, I listed 2,670 cases of foreign body in the cornea. The main points that I wish to bring out in this connection, because they are so often neglected, are proper magnification for the operator, so he can see what he is doing and does not denude a large section of the corneal epithelium, and the necessity, of which all ocular surgeons are doubtless aware, of removing oxidized tissue left after a hot foreign body has been removed. To do this, use the round dental burrs, fitted in a suitable chuck handle, which can be easily and quickly rotated between the thumb and fingers, thus removing the oxidized tissue and leaving a smooth surface without any undercut edges to harbor bacteria or to irritate the eyelid constantly in its passage over the foreign body area.

The late Dr. William M. Sweet of Philadelphia gave me one of the first chuck handles made to hold dental burrs. A new chuck handle has just been finished by the Pilling Instrument Company of Philadelphia, which should make it easy for every one to use the corneal burrs.

Prompt reference of the foreign body case to the eye surgeon benefits both the employer and the employee, and I am convinced after seeing many cases that a rule should be in force in every industrial plant prohibiting any person other than the surgeon from attempting the removal of a foreign body from the cornea with anything except a wet cotton applicator.

The next most frequent cause of injury is a burn, either hot metal, chemical or electric. I shall speak particularly of caustic soda burns. There are quite a number of industries that use caustic soda in large quantities in the solid state and in all percentages of the liquid state. On the first day, caustic soda burns give no indication that they will

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look much worse on the third day than at the time of injury. It is therefore essential that remedial measures be taken immediately to neutralize the caustic soda and to change it to an inert compound. It has been my custom to apply immediately officinal glycerite of tannic acid solution with a cotton applicator, which at once checks the burrowing action of the caustic soda.

There still are persons in this world who look in the end of a gun barrel to see if it is loaded. These same persons look in the end of a frozen, compressed air hose in winter time, and, like the gun, it goes off, with the result that the injured cornea looks like a roughly ground piece of glass. Air hose injuries are of special interest from a diagnostic point of view in cases in which emphysema of the conjunctiva is produced. When the hose slips off the nipple, the worker does not know whether he has been struck by the end of the hose, producing a possible fracture of the nasal and ethmoid bones, or by the débris in the hose which lacerates the conjunctiva and permits the entrance of air, generally under from 100 to 120 pounds (45.3 to 54.4 Kg.) of pressure. This injury produces, on palpation through the eyelid, the typical crackling of emphysema.

Symblepharon can be corrected by Teale's method or by the use of a thin epidermal graft, which is inserted and held in position in the culdesac over a silver conformer made with a large central opening to avoid injury to the cornea.

Lacerated wounds of the cornea near the limbus can be satisfactorily treated by the double triangular flap method, advocated by Dr. P. Chalmers Jameson in 1926, or by the tension flap as used by Dr. Edward Stieren of Pittsburgh. When the center of the cornea is involved, it is best to cover it with a Van Lint conjunctival flap. If a vote were to be taken on the best procedure for the saving of eyes with a penetrating or lacerated wound of the cornea, I feel sure that the Van Lint conjunctival flap would be selected. Many injured eyes have been saved by this excellent method of repair. In penetrating wounds of the cornea, no repair is attempted until a report is obtained from the x-ray laboratory as to the presence of a foreign body in the globe. To warn against hasty, unnecessary operative intervention in these cases, I again call attention to the interesting phenomenon of the false appearance of an opacity and segmentation of the anterior lens capsule, which in most instances disappears before the next dressing.

In cases of punctured and lacerated wounds, hypopyon keratitis and infected ulcers of the cornea, it is my custom to give, every other day, a nonspecific foreign protein. The splendid results obtained leave no doubt as to the value of this method.

To stimulate interest in the possibilities of the removal of nonmagnetic foreign bodies from within the eyeball, I call attention to

the case of a lad about 7 years old, with a large piece of copper in the vitreous, who was treated by a slight modification of my method of removing nonmagnetic lead shot from the vitreous. In this case the tips of a pair of curved mosquito forceps were inserted in the large wound of entrance made by the copper fragment. Following the directions of the fluoroscopic operator, it was possible to grasp the copper and successfully remove it from the vitreous. This was done in May, 1930, and the patient still has a quiet eye. Unfortunately, the damage produced by the injury was so extensive that no vision remained. I am anxious to have others try this method, and I feel sure that when the foreign body is large enough to throw a shadow on the fluoroscopic plate, it will be possible to remove it.

There is little that I can add to the operative technic of the removal of magnetic foreign bodies from the globe and the after-treatment. It is my custom to use only the hand magnet with which all ocular surgeons are familiar, selecting the posterior route unless the foreign body is caught in the iris. I feel that much better work can be done when the magnet is controlled by the thumb of the operator and not by an assistant.

It is my aim to restore the injured worker to as nearly normal a state as possible. When it becomes necessary to remove an eye, I use a modification of the Dimitry operation, and implant a gold ball, usually about 13 mm. in size, in the scleral cavity. The excellent motion of the artificial eye repays one for the extra time and trouble. The following method, I feel, expedites and simplifies the operation: After the scleral cavity is cleaned and dried, a Graefe knife is used to make a semicircular cut around the nerve head, about 3 mm. from it. This fringe of sclera next the nerve head is grasped firmly with mosquito forceps; then, even though bleeding takes place, it is easy to insert a pair of scissors through this incision and cut off the nerve. The forceps can be lifted out with the sclera, turning the latter almost inside out; then it is an easy matter to trim out the nerve head and its fringe of sclera. This change in technic has for me shortened and improved the operation greatly.

Industry produces its quota of accidents so disfiguring that cosmetic surgery must be resorted to, to enable the worker to assume his place among his fellows. My work naturally is concerned with defects of the eyelids, eyebrow, orbit and bridge of the nose.

Cicatricial ectropion, especially when complete eversion takes place, is distressing to both the unfortunate patient and those who observe it. There are many ways to correct such a defect. The surgeon can use Wolfe, sliding, pedunculated or epidermal grafts; in other words, no one type or principle of grafting is applicable to all cases; as in most cases, the surgeon must use his own judgment.

The mere replacement of the skin defect is only a part of the main object desired, namely, the restoration of function with a normal appearance. Following a superficial burn with loss of the skin surface, the eyelids fold back on themselves and unite with a thin fascial attachment, while the edges firmly unite. If the operator will make his incision to the side of the lid and then use blunt dissection, he can enter this area of fascial attachment, quickly separate the attached lid and, after cutting it loose at its marginal attachment, unfold and restore it to its original position.

The advantages gained are a smooth surface for the epidermal graft and a lid with its musculature and nerve supply uninjured, so that after a successful take and proper after-treatment a functioning eyelid will result.

The Thiersch graft, or more properly the Ollier-Thiersch graft advocated by Ollier of Lyons in 1872, was adopted and given great prominence by Thiersch of Leipzig in 1874. In 1917, Esser [1] of Holland wrote an article in the *Annals of Surgery* which proved a great stimulus to plastic surgery. This was adopted and modified by Gillies of England.

Just a few words about the dressing in these cases: It is my custom to cover the graft and the area around it with warm Kerr's modeling compound; over this gauze pads are placed and a roller bandage is applied with firm pressure. A number of small cuts are made in the graft to allow the serum to ooze through the graft and not separate it from the raw surface. The great advantage of this compound in contact with the graft is that the serous exudate forms a coating which permits the dressing to be lifted off without disturbing the graft, and it can be washed and replaced to maintain the firm equal pressure that is essential in producing a successful result.

1. Esser: Ann. Surg. **65**:297, 1917.

PROGNOSIS OF CERTAIN EYE INJURIES*

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In Newark, as in other large manufacturing centers, a majority of eye injuries are the result of industrial accidents. These are of every conceivable variety and all degrees of severity. Since the enactment of workmen's compensation laws, the prognosis of industrial eye injuries has become of increased importance, because in each case the eye surgeon must make an estimate of the percentage of permanent visual loss, if any, resulting from the accident. In most cases an accurate estimate can be made when treatment is ended, but in others the eye must be kept under occasional observation for many months, during which time a slow but gradual improvement may be going on. The healing power of nature is so great, and varies so with different individuals, that no one can immediately and accurately forecast the ultimate visual result of some traumatic eye lesions. This is particularly true of corneal scars, lens and vitreous opacities, wounds of the retina and choroid and paralysis of the ocular muscles. Either with or without treatment, the improvement in some of these conditions over a period of from a few months to a year is often surprising.

Visual impairment resulting from trauma is due to scars involving the central area of the cornea more frequently than to any other one cause. In most cases of from slight to moderate density there is an appreciable clearing of the opacity in time, with corresponding improvement in vision. My impression is that traumatic scars of the cornea clear up to a greater extent than similar opacities caused by certain other forms of corneal lesions, such as those of phlyctenular and neuropathic keratitis. One does not realize how completely some of these traumatic opacities fade out unless one observes them over a long period.

This was first called to my attention rather strikingly, ten years before this paper was written, in the case of a young man who had a central scar of the cornea, 3 mm. in diameter, following a traumatic ulcer. This reduced his vision to less than 20/100. After five months vision was 20/60, and nine months later, or fourteen months after the accident, I was surprised to find that vision was 20/20 and the scar was

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almost invisible. Since then I have seen many similar cases, although in only a few of them was the improvement as great as in the case just cited. However, it is not uncommon to observe, over a period of from six to twelve months, an increase of visual acuity from 20/200 or 20/100 to 20/50, 20/40 or 20/30.

Because of the central location and density of scars of the cornea caused by serpiginous ulcers, the resulting permanent loss of vision is usually very great. Even in these cases the improvement over a long period is sometimes considerable. In the following case of purulent keratitis, seen three years before this writing, the improvement was unusual:

CASE 1.—A man, aged 56, struck his right eye against the end of a twig. The eye immediately became inflamed. When he came to me, four weeks after the accident, vision was reduced to light perception. The surface of the cornea had healed. The eye was red, and there was a large, dense, yellowish-white infiltration (abscess) deep in the center of the cornea and a hypopyon almost filling the lower half of the anterior chamber. As routine treatment, including foreign protein therapy for a few days, caused no improvement, I incised the cornea tangential to the lower margin of the abscess, and expressed most of the pus from the cornea and anterior chamber. It was so thick that it was impossible to remove it completely. However, the residue disappeared in a few days, and in three weeks the eye was quiet. There was a large central corneal opacity, and vision was less than 20/200. The patient went to another part of the country, and I did not see the eye for two years. When he returned, the cornea was nearly clear, and vision was 20/40 plus.

Partial or limited opacities of the lens caused by a small wound in the capsule which quickly closes sometimes clear up partially or completely. This is rather uncommon. More often the opacities remain stationary or increase in size. In the following case a fairly large opacity cleared up completely in five months:

CASE 2.—In April, 1930, the left eye of a man aged 24 was struck and penetrated by a piece of fine brass wire. About 2 inches (5 cm.) of the wire protruded from the eye. He removed it himself. He was sent to my office four days later. In the upper nasal quadrant of the cornea, just outside the pupillary area, there was a small, closed, perforating wound, and in line with this a small perforation in the iris could be seen with the slit-lamp. There were many floating cells in the aqueous. The pupil was round, active and undilated. There was slight pericorneal injection. Vision was perception of fingers at 2 feet (60.9 cm.). After the pupil was dilated with atropine, vision was 20/100, and a large rosette-shaped opacity could be seen in the posterior part of the lens. In size the opacity was about two-thirds the area of the lens. There was also a punctate opacity in the anterior capsule, marking the wound of entrance. To this the iris was adherent, but later the adhesion gave way, and the pupil dilated evenly. Between the anterior and posterior opacities the lens was clear. Nine days after the accident the eye was quiet, and the patient returned to work. During the succeeding five months the posterior opacity became steadily smaller. In October vision was

20/20, and no trace of the opacity could be found with the ophthalmoscope or slit-lamp. The small anterior capsular opacity remained unchanged.

I now have another case under observation in which a similar but smaller opacity is clearing up.

FACTORS IN PROGNOSIS

The majority of penetrating wounds of the eye are caused by flying particles of metal, usually steel. The prognosis of injuries by intra-ocular foreign bodies depends on many factors. Some of these are: (1) the nature of the foreign body; (2) its size, shape and velocity; (3) its location in the eye and the anatomic destruction; (4) infection, exogenous and endogenous; (5) promptness of treatment, and (6) the skill, experience and equipment of the surgeon.

1. Fortunately, as most foreign bodies are of steel they are magnetizable and can usually be removed with a magnet. If not removed they are likely to cause, sooner or later, a chronic uveitis, siderosis or other destructive changes. There are reports of intra-ocular foreign bodies that have been tolerated without damage for many years. I believe that this is very unusual, but have not observed any cases of this kind long enough to justify comment. Several years before writing this article, I removed a small piece of steel from the vitreous of an eye that showed siderosis bulbi. The accident occurred eleven years previously, but the injury was thought to be superficial. The patient came to me because the color of the iris, during the past six months, had changed from blue to yellowish green. After dilation of the pupil the characteristic circle of yellowish-brown spots was found under the lens capsule. Two months after the removal of the foreign body, most of these spots had disappeared and vision had improved from 20/40 to 20/30, but the discoloration of the iris was unchanged.

In another patient who came to me because of failing vision of the right eye, there was a small particle of steel in the anterior part of the lens from an accident that had occurred six months previously. The foreign body had not been discovered. It was surrounded by a small area of opacity. A few spots of siderosis were present under the anterior capsule, and many fine, brown siderosis deposits were seen on the iris. Vision was 20/40. The eye was not inflamed.

Because of the siderosis I removed the foreign body by drawing it through the lens capsule with a magnet and then through a small incision in the upper margin of the cornea. There was no reaction following the operation, but during the next few weeks the lens became opaque. There was no change in the siderosis bulbi.

For over a year I have had under observation an eye that was penetrated through the sclera by a flat piece of nonmagnetic manganese steel. According to the roentgen report, it was in the lower part of

the vitreous, 8 mm. back of the center of the cornea, and was 3 by 4 mm. in size. It could not be seen because of hemorrhage in the vitreous. There was little reaction, and the eye remained quiet. Although the lens was not injured, it became opaque in a few weeks. In another case, similar as to the nature of the injury and the size of the foreign body, the metal was brass. The eye was quiet for a few months, and then a low grade uveitis and a complicated cataract developed.

2. As a rule, the damage and resulting visual loss increase with the size of the foreign body. Smooth bodies are less harmful than those with rough surfaces and jagged edges. If the lens is not injured, most foreign bodies up to 2 or 3 mm. in size, if given prompt attention, can be removed from the anterior chamber and, if magnetic, from the anterior part of the vitreous without serious loss of vision. With larger bodies and those that penetrate more deeply, the results are not as good, and subsequent pathologic changes are more likely to occur.

The largest piece of steel that I have removed from the vitreous without great loss of vision was a rough chip, 8 by 3.5 mm. It entered through the upper margin of the cornea, tearing away a large piece of the anterior layer of the iris. The lens was not injured. The foreign body was located in the upper part of the vitreous, with its posterior point 13 mm. back of the center of the cornea. It was removed the next day, through the wound of entrance, with a Lancaster hand magnet. Wrapped around it was the missing piece of iris. Two months later, vision was 20/50, and the eye was quiet.

Small particles of steel and other missiles traveling at high speed sometimes pass completely through the eyeball into the orbit, where they usually do no harm and cause no symptoms. If the foreign body is metallic the eye is seldom infected. Loss of vision depends on the anatomic damage. Sometimes this is surprisingly slight.

A machinist, while striking a chisel with a hammer, felt something strike his right eye. Examination an hour later disclosed a small linear wound in the sclera on the temporal side, 2 mm. from the cornea. Two small air bubbles were seen in the vitreous, and in the choroid, about 3 disks diameters below the macula, was a small blood-tinged wound. Vision was 20/30. Roentgen examination revealed a foreign body, 1 by 3 mm., in the orbit just outside the eyeball. Five months later there was no evidence of injury except a large white area in the fundus at the site of the injury. Vision was nearly 20/15.

In another case a stray bird shot, reported by a competent roentgenologist to be over 3 mm. in diameter, perforated a man's lower lid, entered the eye through the sclera 3 mm. from the cornea on the nasal side, and went on into the orbit. When I saw the eye three days later, there were several hemorrhagic areas in the nasal half of the retina.

The eye was only slightly inflamed. Vision was reduced to perception of hand movements. Two years later the vision was 20/50. There was a large atrophic area in the retina and choroid on the nasal side.

3. Injury of the lens, prolapse of the iris or ciliary body and hemorrhage in the vitreous are serious complications. In some cases of extensive injury of the lens by a foreign body or other cause, I believe that it is good practice to immediately remove as much of the cortical matter as possible before the eye has become inflamed, thus preventing glaucoma, which so often occurs from the rapid swelling of an injured lens.

4. Flying particles of steel are apparently sterile or nearly so. They seldom carry infection into the eye, but focal infection is often an important factor in causing serious complications. Sources of focal infection should always be looked for when an injured eye is not doing well.

5. As a rule, the more promptly an intra-ocular foreign body is removed, the more favorable is the prognosis. During the first day or two after the accident, it can often be removed through the wound of entrance. The necessary manipulation is easier and safer before the eye has become inflamed.

6. Often the outcome depends largely on the skill and judgment of the operator and his equipment. The latter must include facilities for accurate and prompt roentgen reports and good magnets: a giant magnet and a Lancaster hand magnet. The latter is invaluable in dealing with foreign bodies in the anterior part of the eye.

I have had little experience with sympathetic ophthalmia. A few cases have been seen in consultation. Most of these were in children. In my own practice there have been only two cases. One, which for years I have tried to forget, followed a cataract operation. Both eyes were lost. The other was that of a girl of 2 years, whose eye was cut by a piece of glass. There were a hemorrhage in the anterior chamber and, 3 mm. below the limbus, a 5 mm. ragged linear wound through the sclera into the ciliary body, but no prolapse of the latter. Enucleation was advised and refused. Four weeks after the accident the other eye become sightly injected, and punctate deposits appeared on Descemet's membrane. The injured eye was immediately enucleated, and the sympathizing eye cleared up completely in three weeks.

With these exceptions, I have not had a case of sympathetic ophthalmia in over 200 serious intra-ocular injuries, and have seen very few instances of sympathetic irritation. However, sympathetic ophthalmia, as shown by statistics on the World War and by the published experience of many men who practice considerable traumatic eye surgery, is uncommon. Early enucleation of hopelessly injured eyes

is the one sure preventive, but in most cases it is better to wait a week before advising enucleation, because some eyes which seem almost hopeless at first improve very much in a few days; moreover, few patients will consent to an immediate enucleation. Only after efforts to save the eye have proved useless and he has suffered from the pain of an iridocyclitis or panophthalmitis for a week or two, will the average patient permit his eye to be removed. I have watched, for weeks and sometimes months, severe injuries of the iris and ciliary body, often with incarceration in the cornea or sclera, but nothing has happened to the uninjured eye. As I nearly always have at least one such case under observation, I live in constant fear that my luck will not continue. When there is a wound through the cornea or limbus, prompt and wide abscission of the prolapsed iris and the covering of the wound with a conjunctival flap will often avert serious complications.

It is sometimes difficult to decide when to advise enucleation. If there is a fair probability of saving some useful vision, I feel like taking a chance with almost any kind of an injury. In most cases, when the damage is severe and there is a loss of vitreous, prolapse of the ciliary body or traumatic cataract, the eye should be removed at once. Danger signs that should always be heeded are persistent, unabated iridocyclitis, increasing lowering of the intra-ocular tension and turbidity of, or cells in, the aqueous of the uninjured eye. I believe that a retained foreign body in an eye with useful vision is not of itself, in the absence of symptoms, an indication for enucleation.

WORKMEN'S COMPENSATION PROBLEMS*

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Comparatively few doctors, except those connected with insurance carriers, realize their outstanding importance in workmen's compensation administration. Unfortunately, it is a fact that too many in the profession are unaware also of their great responsibility, socially and economically, in connection with treatment in compensation cases. In ordinary cases the physician has the single duty of diagnosing and treating ailments. In compensation cases, however, there is another distinct duty, not only to the claimant but to society as well, that of determining whether and to what extent the disability and its cost are chargeable against industry in the form of compensation. In the state of New York not a single dollar of compensation may be awarded for disability, temporary or permanent, without the certification of a doctor. When one considers that the total yearly awards amount to $36,000,000, all of which is based on medical opinion as to the duration and extent of disability, one can readily grasp the economic and social importance of the doctor in the administration of workmen's compensation. In exercising this power the doctor is obliged to summon faculties outside of technical skill. He must, in addition, exercise rare judgment of human nature and of human motives.

In no field or branch of medicine is this responsibility more pronounced than in the branch of ophthalmology. In no other division is there required closer study of cases or keener professional analysis to bring about just and equitable disposition. In the first place, accurate measurement of vision is frequently difficult because of factors over which the doctor has no control, as for instance, the noncooperation of a patient, illiteracy and the changing of pathologic conditions as well as variant circumstances under which examinations are conducted. Further the ophthalmologist in compensation administration is a conspicuous factor because of the great frequency of eye injuries and their relatively high cost as reflected in compensation awards. Three out of every 100 awards in this state are for eye injuries. Approximately 1,000 awards are made annually for permanent or partial loss of vision. These amount to over $1,500,000, with an average cost of $1,800. In addition

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to the permanent injuries there are annually about 2,000 cases of eye injury causing temporary disability only.

These figures indicate that eye injuries are numerous and extensive. There are other reasons, however, why the Department of Labor singles them out for special watchfulness, from the angle of both accident prevention and case adjudication. First, of course, is the universal terror of blindness or even partial blindness, which begets caution. Aside from this, seventeen years' experience has disclosed hundreds of pitiful cases in which early neglect or carelessness brought tragic results in loss of sight, sometimes infections caused by fellow workmen removing foreign bodies with dirty handkerchiefs, perhaps the failure of the first aid nurse to recognize the seriousness of a condition, and even in some instances the apparent lack of thoroughness on the part of the doctor.

Three years ago the statute requiring employers to report accidents was modified so that only those injuries are reportable which disable workers beyond the date of injury, or which require more than ordinary first aid. In defining the term ordinary first aid, the commissioner, on counsel of our chief medical advisor, explicitly excluded eye injuries, which, said Dr. Lewy, should be referred to a physician in every instance.

In eye cases, too, the department makes an exception and will not close a case unless a medical report is filed. Moreover, a special effort is made to have claims filed in every reported instance. The latter is because of the frequency of cases in which total or partial loss of vision due to trauma resulted after the legal period during which a claim may be made.

The department is constantly pointing out to doctors the necessity for making and retaining complete case records. Experience has taught that record keeping is even more necessary in eye cases than in most other forms of injury. The present form for the use of ophthalmologists in reporting compensation injuries (C-5) is rarely completed in full. An astonishing number of medical reports fail even to indicate which eye is injured. Many physicians seem reluctant to answer the all-important question as to whether the injury has produced loss of vision. Then there is the prime matter of a full description of the injury. Relatively few oculists make use of the diagram on the back of the C-5 form to indicate exactly where the ulcer, puncture or injured portion is located. It should hardly be necessary to point out that the reports should include visual tests and a pathologic description of the uninjured eye. These data are of grave importance in many cases in which the issue is one of activation or precipitation of a dormant disease. It is likewise frequently important for comparative purposes in measuring the visual loss in the injured eye. Any one, whether layman or physician, familiar with the history of cases in compensation procedure will agree

that this matter of accurate and complete records cannot be overemphasized. Only recently an up-state referee called my attention to a problem case in which the claimant, an electric welder, had sustained an injury to the eye three years before in the form of a burn from a spark. The first aid man of the plant recorded it as an injury to the left eye. The plant doctor's records were lost, but the ophthalmologst to whom the plant doctor sent the case recorded the treatment only to the left eye. He testified that while he made no descriptive record of a pathologic process in the right eye, he was certain that he would have done so if there had been complaints as to that member. Today the patient is blind in the right eye from what specialists assert is traumatic cataract. We have no claim record for an injury other than to the left eye, and though the referee honestly believes that industry is responsible for the loss of vision, the claim must be disallowed because the statutory requirement of a claim within two years of the date of injury has not been met.

I myself presided in a case that occasioned an endless amount of litigation because a doctor who died before the proceedings started had erroneously indicated in his records treatment of the right eye instead of the left which was actually the injured member.

While it is hardly becoming in a layman to venture advice as to technic in eye examinations, a study of case adjudications makes certain points under this head manifest even to those outside of the medical profession. For instance, every one knows the prevalency of cases of psychogenic or ocular neurosis in compensation work. Laymen are aware of the difficulty facing an ophthalmologist in diagnosing this somewhat illusive condition. In fairness to the claimant, to industry and to the state, it would seem advisable that the oculists make this diagnosis with definiteness only in conjunction with a neurologist.

Again, the common complaint of visual disturbance in connection with head injuries seems to call for the consistent use of x-rays in definitely locating the cause.

Further, the frequency of contentions over pathologic changes in eye cases under adjudication assuredly indicates the advisability of careful slit-lamp study to a greater extent than now seems prevalent. It seems to a layman that the science of ophthalmology at its best is like genius, an infinite capacity for taking pains. From the standpoint of reducing long drawn out controversy, the oculist who takes the extra time necessary for minute examinations is a conspicuous asset to the Division of Workmen's Compensation.

I think it pertinent to this discussion and of value to the ophthalmologist, as well as to others concerned in the administration of compensation, to keep in mind the general principles of the statute itself. It is not a damage law. Its monetary benefits or recoveries are based on either actual or theoretical loss of earning capacity. Thus the one hun-

dred and sixty weeks of compensation, or a maximum of $3,200, for the loss of an eye in this state is but a theoretical calculation of loss of earnings that the injured person may sustain throughout the balance of his life. No one knows whether this particular schedule approaches accuracy. In the schedules of permanent partial losses only four members are rated higher than the eye in compensation awards, namely, the arm, leg, hand and foot. It is possible and even probable that the loss of a thumb, for instance, for which the workers receive only seventy-five weeks of compensation may actually result, in many instances, in a greater loss of earning capacity than the loss of one eye. It seems to me, however, that the grave hazard that the one-eyed worker faces in the possible loss or impairment of the remaining member fully justifies the relative value in compensation recovery under the schedule as it is today.

The system used in measuring partial loss of vision, though frequently challenged, is doubtless as accurate and as reasonable as can be devised. It recognizes the reading of 20/20 on the Snellen chart as normal, with fractional graduations to 20/100 at which point (in other words, with an 80 per cent loss of visual acuity) there exists blindness under the Compensation Law. The statute simply says: "Compensation for loss of binocular vision or for 80 per centum or more of the vision of an eye shall be the same as for an eye." It may be of interest to many to learn that there has been an important development in the construction of the statute relating to loss of binocular vision only within the last eighteen months. For many years the department has construed the quoted statute to mean that any disturbance of muscle balance or diplopia in any degree constitutes officially the loss of an eye, and a great many awards were made in accordance with this construction. However, a little over a year before this writing the Appellate Court held that partial disturbance of binocular vision, that is, confined to one quadrant, did not necessarily justify an award for the total loss of use of an eye.

So at this time the staff oculist of the department record the entire loss of an eye if there is manifest deviation in a primary position but a loss of only 15 per cent vision, for instance, if diplopia exists in but one of the six cardinal positions (right, left, right and up, right and down, left and up and left and down).

Under the theory of compensation principles, firmly fixed by court interpretation in this state, traumatic activation or precipitation of a latent condition is the equivalent of causation. Under this theory there are presented to the department a very large number of cases in which one must determine whether and to what extent the injury incited the onroad or development of the diseases which in themselves are capable of reducing or destroying vision. A few of the more frequent examples include glaucoma, latent tuberculous conditions and syphilis. The latter

cases present extremely difficult problems, and in connection with them there arises a great deal of medical controversy. Unhappily, I think, ophthalmologists must still rely on European authorities in determining the effects of trauma on various preexisting conditions. I have heard the reports of a great many eye cases as a referee in the department, and I cannot recall a single instance in which a testifying specialist referred to a textbook of an American authority. To me this seems somewhat strange when one considers that New York State adjudicates more workmen's compensation cases annually than any other sovereignty in the world, so far as I am aware. With the experience of the past fifteen years and with the constant stream of eye injuries flowing into the department, it would appear that here at home there is a vast field for study and research and a splendid opportunity to compile, first hand, authoritative data on this extremely important subject.

In opening this subject, I expressed regret that a great many physicians in this state are unaware of both their importance and their responsibilities in compensation administration. It should be stated that doubtless the department itself is partly responsible. In carrying on its busy job of handling and adjudicating 200,000 cases a year there has been no sustained effort to lay the subject before the medical profession in detail. Nearly two years before this paper was written, however, the present commissioner took steps to correct this omission. Since then, through appearances before medical societies, through radio talks and through printed bulletins, an endeavor has been made to secure the ear of the physician to the end that he will have a better understanding of the scope and purpose of the law and detailed information as to its administration. I am happy to say that at this late date the staff ophthalmologists of the department are assembling valuable data from studies of the large number of eye cases presented. I can say that the comissioner, through the medical department of this organization, will be glad to present the result of these studies and indeed will be glad to bring to the attention of the section those types of cases in which any member may be interested from the standpoint of research.

OPHTHALMOLOGIC IMPORTANCE OF FOCAL INFECTIVE PROSTATITIS*

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It would seem presumptuous for one whose field of endeavor lies so far from the eye as does that of the urologist to raise a voice regarding ocular conditions. It has been my privilege, however, during the last twelve years to treat for various ophthalmologists the urogenital infections of many patients presenting those varied eye diseases of focal infective origin. There have been a few cases of uveitis and choroiditis, a large number of iritis and still a far larger number of ulcerative keratitis. And the experiences with these cases have served to bring out a number of points not generally known to the ophthalmologist, points that should be of the utmost importance to him. Because of this an effort will be made to recite the observations and experiences in these cases in the hope of exhibiting a much neglected field of curative procedure.

Throughout these years it has been evident that many ophthalmologists, like many internists, have not realized the immense importance of infections of the prostate gland in the causation or continuance of that multiplicity of disabling conditions commonly ascribed to the effects of toxic absorption from some limited focus of infection. With the latter they have shared the totally erroneous impression that this gland only becomes infected as the result of gonorrhea. They needed no more than the patient's statement that he had never had this disease to dismiss the prostate from their consideration of focal infections. Such a belief has worked incalculable harm in both fields of medicine and rests on a very flimsy foundation, practically on no foundation. It is a fact easy of proof that, after the age of 35, infections of the prostate seldom have any relation to gonococcal infections. In a recent series of one hundred unselected cases of focal infective prostatitis presenting distant absorptive symptoms, only two patients had had gonorrhea within twenty years of the time of study and only seven had ever had that disease. It, therefore, is evident that the absence of gonorrhea in the previous history in no sense acquits the prostate. And it is equally obvious that no study of focal infections in the male is a thorough one that does not include a study of the prostate gland.

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* From the Department of Urology, University of Pennsylvania.

While on the question of gonorrhea, I cannot refrain from raising a definite question regarding the prevailing belief that this disease so commonly causes iritis. I do not say that it cannot cause iritis, but that there is ample reason to believe that many cases are attributed to that disease that have no direct relation to it. Not only have I never seen a man among the many thousands I have treated for gonorrhea develop iritis while the gonococcus was present, but, in rather an abundant experience, not one of those with a supposed gonorrheal iritis who have been referred to me for treatment has really had gonorrhea when referred. In fact, none had had it within a year of the development of the iritis. These experiences have been with the male, and, unless iritis is decidedly more prevalent in the female, it is obvious that gonorrhea as a direct cause can be discounted very generously. Here, as in other fields of medicine, one's past often is resurrected to mock him. Unquestionably most of these cases are true focal infective iritis and, as such, belong to the group under discussion in this paper.

Another fact equally easy of proof is that at least 35 per cent of all men beyond the age of 35 have a prostatic infection. Further, at least 72 per cent of all men presenting symptoms of a focal infection of any sort have an easily demonstrable prostatic infection. Thus it is seen that it is an extremely common condition. Also, it is a condition of which the patient is frequently unaware. For, aside from some shreds and microscopic pus in the urine or an occasional urethral moisture, which is usually unnoticed by those of easy conscience, it rarely produces any local symptoms to arouse the patient's attention. Being locally almost a silent lesion, it must be searched for by the physician, and that such searches are of considerable importance to the oculist is shown by the fact that of the aforementioned one hundred unselected cases fifteen were ocular conditions of focal infective origin which were cured by the changes brought about by prostatic treatment.

Contrary to the belief rather generally held, prostatitis usually is quite a respectable malady, and he who has focal infective prostatitis rarely has any need to be ashamed of it, for it is not a so-called mark of sin. Usually it is an infection secondary to a more distant focus, predominantly in the teeth or tonsils. Occasionally it owes its origin to a gallbladder disease, an attack of influenza or some other acute infectious disease of a systemic nature. Of the one hundred unselected cases, infected tonsils were noted in sixty-nine and infected teeth in sixty-one, while fourteen showed neither and forty-six both.

From the standpoint of systemic symptoms of focal infection, it is obvious that the focal infective triad in the male is tonsils, teeth and prostate gland. In ophthalmologic fields, however, it is probable that the facial sinuses must be taken into consideration to a greater degree

than is the case with the general medical aspects of the question. For infections of the facial sinuses usually cause their symptoms above the shoulder level, which is not to any great degree the rule with tonsillar and dental infections. Singularly enough, there also is little reason to think that sinus infections act as primary foci to prostatic infections. At least, I have not been able to trace such an association in a single case. Not that some of my patients did not have infected sinuses, but all of those who did also had either infected teeth or tonsils. Further, persisting sinus infections in no way retarded recovery from the prostatic infection, whereas persisting tonsillar or dental infections almost invariably prevented such recovery.

In the consideration of my experiences with focal infective ocular lesions, it is within the bounds of truth to say that they have been, with but few possible exceptions, caused or kept up by a focus of infection in the prostate gland. One makes room for a few exceptions by virture of the facts that mistakes often are made regarding the absence of further tooth-root infections, and some tonsils are considered normal when they in reality are infected. Aside from mistakes in reading roentgenograms of the teeth also looms the fact that 64 per cent of those patients presenting tooth-root infections had later dental infections. These dental reinfections usually took place some months after the ocular lesion was cured, so that one can safely consider the ocular condition as being kept up by the prostatic infection, and can justly base one's opinions on this greatly narrowed field, for all of the patients had had attention given to the more distant foci of infection when the prostatic treatments were started.

It, therefore, is correct to say that some focal infective eye conditions occur solely because of prostatic infection, but that more occur because the eye lesion was due to some other infection, the initial work of which was kept going by a prostatic infection. Both of these statements are shown to be true by the ease with which the eye condition can be cured by gentle, careful attention to the prostatic infection in the absence of any local treatment to the eye itself. From this, however, one should not assume that no such eye conditions ever clear up without prostatic treatment, for desensitizations are fickle, and there is no reason to suppose that some focal infective eye conditions, like some cases of arthritis, will not subside temporarily and, perhaps, permanently, while their causal foci still are present. The number evidently is not large enough, however, to warrant one in thinking lightly of such foci.

It is probable that every oculist dreads in these patients the ocular reaction that so often follows the removal of teeth and tonsils. A like apprehension justly can be entertained for the possible reactions result-

ing from rough manipulation of the infected prostate gland. When such a gland is massaged, it is almost the rule to see a subsequent increase in the ocular symptoms. The severity of this reaction depends to such an extent on the firmness of the pressure on the infected gland that such manipulations must be viewed from a quantitative standpoint.

Eleven years ago I called attention to the occurrence of a distinct increase in the distant symptoms of focal infection as the result of digital disturbance of the prostate gland in many cases of neuritis and arthritis. It since has been my experience that the same thing occurs in focal infective eye conditions that have any relation whatever to prostatic infection. So invariable is this reaction in such eye conditions that its failure to take place after one of the first few prostatic treatments is almost positive proof that the prostatic infection has nothing whatever to do with the ocular difficulty.

It is evident that this increase in distant symptoms is occasioned by the forcing into the system of larger quantities of the particular toxic substance responsible for them than ordinarily are absorbed by the individual. This reaction, being in every way analogous to a vaccine reaction with remarkable specificity for the distant lesions, brings into the foreground some matters of the utmost importance, particularly when one is dealing with such a delicate organ as the human eye. For it is evident that an eye strained to its threshold of toxin tolerance may be irreparably damaged by sudden increases of toxin beyond this point. Particularly is this true in regard to iritis, and I have seen vision almost destroyed by a prostatic massage that was too energetically given by a physician in a distant city to whom the patient was referred.

Not only may great damage be done by too often or too firmly massaging the prostate of these patients, but such eye conditions may be kept up indefinitely by failing to view such treatment from the standpoint of toxin dosage. And the physician cannot plunge blindly along with such treatments as in postgonococcal prostatitis. He must so graduate his pressure on the gland as never to cause more than the slightest eye reaction, and he does better if he causes no reaction. He should not repeat his massage until at least three days after the subsidence of a rreaction that may have followed his former treatment, and, if the eye is getting worse instead of better despite his gentleness, he had best discontinue his treatments altogether until the eye condition settles into a stationary stage or shows improvement.

So far as the prostatic infection itself is concerned, one thinks of treatment mainly from the standpoint of drainage of purulent products and the stimulation of immunity. But in focal infective eye conditions such treatments must be viewed solely from the standpoint of ocular sensitization and desensitization to toxin, and few therapeutic procedures

require more judgment and restraint on the part of the urologist. Surely one never should carry out prostatic massage in such patients while vaccines of any type are being administered to them. For such massage is virtually an autovaccination which, properly controlled as to amount and as to frequency, has remarkable curative powers. Any disrespect of these factors may easily cause irreparable damage to an otherwise curable eye.

My deep ignorance regarding the minute features of ocular diseases, together with some questions I have been called on to answer for my ophthalmologic friends regarding prostatic infections, suggests that there might be some who are not so fully conversant with things so routine in my branch. With such a thought in mind it might be well to sketch briefly a few of the outstanding points regarding prostatic infection, its diagnosis and its treatment.

In persons between the ages of 18 and 30, most prostatitis is gonococcal in origin. In later life such is rather rarely the case, as has been stated. The gland can be, and commonly is, literally filled with pus without giving any local subjective symptoms. There may or may not be evidences of such infection in the urine, and the gland, per rectum, generally presents nothing to suggest that infection is present.

The diagnosis of prostatic infection rests solely on the microscopic study of the digitally expressed prostatic secretion. This is examined in the fresh condition by overlaying a drop of it by a coverslip. The normal secretion never shows more than five leukocytes to the one-sixth inch field, and any number above this should be considered evidence of infection. Clumping of pus cells is evidence of poor drainage. As treatment proceeds, clumping should disappear and the pus cells should gradually reduce in number.

The focal infective prostatitis apparently does not spontaneously recover, nor can it be cured by treatment so long as its causal focus in the teeth, tonsils or elsewhere persists. Failure to proceed toward cure under treatment or relapse after apparent cure as a rule is evidence of a recurrence of infection in the teeth or tonsils.

Treatment for the infected prostate consists in massage of the gland not oftener than twice a week. Such massage should be done with a care and gentleness appropriate to the local and remote reasons for it. It takes at least three months to eradicate such an infection.

SUMMARY

1. The general focal infective triad in the male is teeth, tonsils and prostate gland. In eye conditions the facial sinuses also play a part.

2. Focal infective eye conditions occasionally are due solely to infections of the prostate gland.

3. They commonly are kept up by prostatic infections after the removal of foci in the teeth, tonsils and sinuses.

4. Such prostatic infections usually are secondary to tonsillar or dental infections, and only rarely have any relation to gonococcal infection.

5. At least 35 per cent of all men beyond the age of 35 have a prostatic infection.

6. At least 72 per cent of all men with focal infective symptoms have an infected prostate.

7. These prostatic infections cannot be permanently cured so long as their causal foci in the teeth or tonsils persist.

8. An increase in ocular symptoms usually follows one of the first digital manipulations of the gland.

9. If no such increase occurs, the gland is practically acquitted as a factor in the causation of the eye lesion.

10. This increase in ocular symptoms is analogous to a vaccine reaction with marked specificity for the distant lesion caused by the prostatic infection.

11. Treatment of the gland, therefore, must be viewed from the standpoint of ocular tolerance to toxin.

12. To exceed this threshold of toxin tolerance is to incur great risk.

13. Recovery from such ocular conditions is retarded by severe reactions and hastened by treatment causing the slightest or no reaction.

14. Prostatic massage should not be carried out oftener than twice a week.

15. It should not be repeated within three days of the subsidence of a reaction caused by a previous treatment.

16. If the eye condition improves as the result of prostatic massage and then remains stationary, there probably is a recurrent dental infection, the supposedly normal tonsils are in reality infected ones, or there is further trouble in a facial sinus.

17. If the eye condition becomes worse as the result of prostatic massage of the gentlest type, it is evident that the toxin threshold is so low that the prostatic manipulations should be stopped until the eye condition reaches a stationary stage or definitely improves.

18. Few methods of treatment require more judgment and restraint than does the attack of a prostatic infection in the presence of a focal infective eye lesion.

THE IOSKIASCOPY TEST *

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The ioskiascopy [1] test, the latest subjective method devised for testing and measuring astigmatism, was first presented at the last International Congress of Ophthalmology at Amsterdam. It has already made its way into several of the European clinics and to some extent into private practice. While not quite sharing the conviction of the originator, Dr. Raubitschek, that the test will ultimately supplant all other subjective tests for astigmatism, I do believe that it offers some unusual features and deserves a place alongside other sensitive tests for astigmatism.

TECHNIC

The technic of the test is rather simple, although the theory underlying the apparatus and technic is a bit complicated. This will be briefly touched on later. The testing apparatus consists of a revolving disk set in a fixed frame. Surrounding the disk on the fixed frame are two scales, an outer one to be used when testing with plus cylinders and an inner one to be used when testing with minus cylinders. The outer scale is marked according to the "Tabo" system as seen by the patient, i. e., zero on the horizontal to the left, ascending clockwise. The inner scale is marked in the same manner but displaced 90 degrees to the right. The starting point zero is thus on top in the vertical meridian, thence continuing clockwise. On the revolving disk is an arrow made up of two parabolic arcs. These arcs are so placed that at one end they are parallel and close together, thus forming the tip of an arrow. From here the two arcs diverge, at first slowly, then more rapidly until they terminate at the other end of the disk farthest apart from each other, thus forming the base of an arrow. The final direction of the arcs at the base is at right angles to the original direction at the tip.

The two arcs constituting the arrow comprise, with infinite gradations, all possible directions of astigmatism. The arrow may be likened to a fan chart in which the angle of deviation between the radiating lines is infinitely small. In this respect the ioskiascopy disk presents a novel application of the radiating line principle with a fineness not obtainable in any other way. In case of astigmatism, the direction of the clearest line on a fan chart would be represented by a corresponding tangent to some portion of either arc of the arrow. Each arc is made up of a central black line bordered by two white lines, the whole set on a gray background. When the arcs are out of focus, the black and white tend to blend with the gray of the background becoming more or less indistinguishable from it.

Before using the ioskiascopy test, it is usual to determine, at least approximately, by means of ophthalmometer and retinoscope, the principal meridians and the amount of the astigmatism. But it is possible to make a complete astigmatic test

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1. The word "ioskiascopy" comes from the Greek, "Ios" arrow, and refers to the "shadow" or black streak in the arrow. It has nothing to do with objective skiascopy, better known as retinoscopy.

without the use of preliminary objective tests, although more time and labor are necessarily consumed. For the sake of completeness, I will discuss making a complete test by ioskiascopy alone.

The necessary steps in a test for astigmatism are naturally three: (1) determination of the presence or absence of astigmatism; (2) if astigmatism is present, determination of the location of the principal meridians; (3) measurement of the amount. To determine the presence or absence of astigmatism, the arrow is placed in any convenient position, say, pointing upward, and the eye is definitely fogged until the arrow on the disk, from 4 to 6 meters away, is not distinguishable. The fog is then gradually reduced until the whole or some portion of the arrow comes into view. If the whole arrow comes into view at once, the patient is asked if the right and the left wing of the arrow appear equally black. If they do, the arrow is turned, say 45 degrees to the right, and the question repeated. If they still look alike, the arrow is turned to one more position, for example, 45 degrees to the left of the first position, and the question repeated. If the wings of the arrow still look alike, one may definitely conclude that there is no astigmatic error present.

It was said before that the patient is asked to compare the two wings (arcs) of the arrow. It is best if he compares not only the two arcs as a whole but the corresponding portions of the two arcs, for instance, at the tip, the middle and near the base. This makes it rather easy for the patient to judge of equality or inequality in distinctness. But not only the corresponding portions of the two arcs can be compared but also the adjacent portions of each arc. In other words, valuable information is obtained when the patient looks at one of the arcs from tip to base and notes whether it is equally clear throughout its length. If, for instance, when the arrow is placed pointing upward, the patient says the two wings of the arrow appear alike and that each wing is equally clear or blurred throughout its length, there is surely no astigmatism present. The information is exactly the same as if the patient said that all the lines on a fan chart appeared exactly alike. The same holds true with the arrow placed in any other position. So that by comparing the adjacent parts of each arc it is really not necessary to use more than one position of the arrow in order to exclude astigmatism. In practice, however, it is generally easier for a patient to compare the two arcs of the arrow with one another, and when only this method of comparison is used, the arrow must be placed in several positions; three positions, say 45 degrees to either side of the initial position, are amply sufficient for this purpose.

Suppose, however, only the tip of the arrow comes into view as the eye is unfogged, or only some other portion of the arrow comes out distinct, i. e., there is the appearance of a black streak or "shadow" in one of the arcs. Then astigmatism is indicated. If the black streak or shadow settles at the arrow-tip, i. e., in both wings at the tip, then the two arcs appear alike and the arrow now points to one of the principal meridians, in fact, to the most defective meridian. If the streak appears along one of the arcs in some portion off the tip, the arrow does not point to one of the principal meridians. The arc containing the black distinct streak or so-called "shadow" appears as a whole plainer and more distinct. The arrow must now be turned away from the side containing the plainer arc, i. e., the arc with the shadow, until the shadow settles in the tip of the arrow and invades equally both arcs at the arrow tip. This position of the arrow locates the position of the axis on the inner scale when minus cylinders are to be used, or on the outer scale when plus cylinders are to be used. The least turn of the disk from the right axis will cause a rapid shifting of the streak from the arrow-tip onto the body of one of the arcs creating at once a marked contrast in the two arcs. By balancing the

shadow exactly at the tip, the examiner is enabled to make an accurate determination of the axis, sometimes to within 1 degree.

The reason for the shifting of the streak on rotating the disk will be readily understood by referring to the fan chart. Suppose there is a direct astigmatism (with the rule), the principal meridians being 90 and 180 degrees; the clearest line on the fan chart, the best focused line, would be the vertical line. The lines radiating to either side of the vertical would be seen as more and more blurred. When in this case the arrow-tip is placed vertical, the two vertically running parallel lines at the tip are best focused and carry the black streak or shadow and the rest of the arrow fades away more and more. If the arrow is now turned, say 10 degrees to the right, the part of the arrow corresponding to the blackest vertical line of the fan chart is the tangent to some portion of the right arc; accordingly a piece of the right arc considerably removed from the tip appears black. This extensive movement of the shadow is due to the fact that at the tip the arcs have their least curvature and tangents that are but slightly inclined to one another strike the arc at points considerably far apart. If the arrow is turned still more to the right, the black streak shifts again moving nearer to the base. In this example the black streak must always correspond to that portion of the arrow the tangent of which is vertical, and as the arrow is turned, different portions of each arc come into this vertical position and appear as having a black streak or shadow. If in this example, the arrow is turned from its initial position pointing upward full 90 degrees to the right, the black streak will leave the tip and occupy successive portions of the right arc clear to the very end of the base. If the arrow is turned from the vertical position full 90 degrees to the left, the black streak will likewise leave the tip and occupy successive portions of the left arc clear to the end of the base. It is thus seen that the streak balances evenly at the tip, occupying both arcs at the tip, only when the latter is in one of the principal meridans (the most defective meridian). When the arrow is turned from this position, the streak travels along either arc making a continuous and smooth passage from one end to the other. When the arrow has an off-axis position, the streak appears in some off-the-tip position, along one of the arcs, and the two arcs appear then markedly unlike.

From the foregoing discussion, it will be clear to the reader why astigmatism is indicated when one wing (arc) of the arrow is blacker and more distinct than the other wing. The blacker wing carries the black focused portion. It will also be clear why the arrow is turned away from the arc containing the shadow in order to locate the principal meridians. The disk is turned until the two wings of the arrow appear alike and the shadow (black streak) balances at the tip. The arrow-tip then points to some number on the inner scale and to a different number (differing by 90 degrees) on the outer scale. The number on the inner scale gives the correct axis if one is going to measure the astigmatism with minus cylinders. The number on the outer scale gives the correct axis if one is going to measure the astigmatism with plus cylinders.

To measure the amount of astigmatism, an entirely novel method has been introduced. This method has been employed objectively in the latest developments of cylinder retinoscopy.[2] Professor Lindner of Vienna also at one time suggested the application of this principle for subjective testing. But the ioskiascopy test is the first practical application of this principle in subjective work. The theoretical basis rests on the effect of two obliquely superposed cylinders of opposite sign. Such a combination is produced when the correcting cylinder is placed off-axis before an astigmatic eye. This combination always produces a resultant

2. Pascal, J. I.: Modern Retinoscopy, London, The Hatton Press, Ltd., 1930.

mixed astigmatism, the component parts of which are equal or unequal according as the original powers were equal or unequal. If they were equal, the principal meridians of the resultant astigmatism are symmetrically placed between the original powers, and their position can be easily calculated. This fact is utilized in determining the amount of astigmatism in the following manner.

Assume the test is made with minus cylinders. The eye, if not naturally myopic, must be rendered myopic by means of plus lenses. In fact, the very lens that was used to fog the eye slightly in order to determine the axis is now used in order to determine the amount. Suppose the axis was determined as 150 degrees on the inner scale. A minus cylinder of convenient strength is then taken and placed in the trial frame not at axis 150 degrees (the correct axis), but oblique to it, at an angle of, say 10, 20 or 30 degrees. The strength of the lens to be taken as a first trial depends on the examiner's judgment as to the probable amount of astigmatism. The readiness with which the axis is located will be some guide. However, much time need not be lost in deliberating on what strength to begin with, as a minus 1.00 diopter cylinder is in general a good lens with which to start. The angle of inclination may also be taken at will. In general, when low astigmatism under 1.00 diopter is suspected, a rather large angle is desirable, for example, 30 degrees. When a medium amount of astigmatism is suspected, say between 1.00 and 2.00 diopters, an angle of 20 degrees may be chosen. For higher amounts of astigmatism a small angle, one of 10 degrees, may be taken. In want of anything definite, an angle of 20 degrees may be taken as most suitable. In my illustration, then, the 1.00 diopter cylinder is placed 20 degrees off 150, either at axis 170 or at axis 130; say, 170 degrees is chosen. One now refers to the tables furnished with the instrument and looks up on a set of coordinates the number corresponding to a true axis of 150 and a false axis of 170. This gives no. 25, which means that the arrow-tip must be turned toward no. 25 on the inner scale. This position is the symmetrical position for the plus component of an equally balanced resultant astigmatism. Such an astigmatism is created in case the minus 1.00 diopter cylinder exactly balances the amount of astigmatism; in other words, when the chosen cylinder is exactly right in strength. The patient is now asked if the two wings of the arrow are equally distinct. If they are (the streak then balances at the arrow-tip), the cylinder is exactly of the right strength. If, however, the patient sees one wing of the arrow darker and more distinct, the streak is then in one of the arcs and the cylinder is either too weak or too strong. Stronger or weaker cylinders, respectively, are then used until the two wings of the arrow are equally distinct and the shadow balances at the tip. Whether to use stronger or weaker cylinders than the initial one depends on which wing of the arrow is the more distinct. If it is the wing nearer the axis ("Tabo" as seen by the patient), a stronger cylinder is required. If it is the wing farther from the axis, a weaker cylinder is required.

The essential points then are that once the axis is determined, a minus cylinder, for example, minus 1.00 diopter, is inserted at a known obliquity to the axis, say 20 degrees off axis. From the true axis position and the false axis position the required position of the arrow-tip is ascertained by reference to the tables. The arrow is placed in that position, and the patient is asked which wing of the arrow is blacker and more distinct. If it is the wing nearer the axis, more minus cylinders must be used. If it is the wing farther from the axis, less minus cylinders must be used until the two wings appear exactly alike.

It will be noted that the right cylinder strength is determined while the cylinder is placed in an off-axis position. After the right strength is found, the cylinder is placed in the right position and the fog reduced by minus sphericals.

The balance of the test is conducted on the usual letter charts, Snellen or others, as if there were no astigmatism present.

If the test is made with plus cylinders, the procedure is essentially the same with a few important differences. Say the axis, while the eye was under fog, was found to be 80 degrees on the outer scale (the outer scale for plus cylinders). A plus 1.00 diopter cylinder is then placed at an angle of 20 degrees to the right axis, for example, at axis 100. But when placing the plus 1.00 cylinder, the sphere has to be reduced by substantially the same amount. The test for the amount of astigmatism with plus cylinders must not be made with the eye so fogged that the hyperopic astigmatism is turned into myopic astigmatism. Therefore, every time a plus cylinder of different strength is inserted, a corresponding reduction in the strength of the sphere must be made. By referring to the tables, one finds for the coordinates 80 (true axis) and 100 (false axis) the resultant no. 135 on the outer scale. The arrow is then set pointing to 135, and the patient asked which wing of the arrow is more distinct. If both wings are equally distinct the plus 1.00 diopter cylinder is just right in strength. If one wing is more distinct, stronger or weaker cylinders must be used until the two wings appear exactly alike. Here, however, if the arc nearer the axis is blacker, a weaker plus must be taken; if the arc farther from the axis is blacker, a stronger cylinder must be taken in order to equalize the wings of the arrow. This is just the reverse of the procedure with minus cylinders. An accessory table is furnished with the instrument which tells whether to take stronger or weaker cylinders so that one need not memorize these rules.

However, since when using plus cylinders the spherical lens must be constantly changed corresponding to changes in the cylinder in order to avoid creating an artificial myopia, the procedure is rather cumbersome and testing with minus cylinders is preferable even in cases of hyperopic astigmatism. In this way all that is necessary to remember in changing cylinders is nearer—more minus (n. m. m.). If the nearer wing is blacker, use more minus; if the farther wing is blacker, use less minus in order to equalize.

CONCLUSION

In conclusion, it may be said that this presentation of the new ioskiascopy test does not aim to be either exhaustive or complete. There are many minor details that go with the test and that are learned with practice. It is hoped, however, that the reader will get from this article some intelligent appreciation of the theory and practice of this new test as a basis for further reading.

WAYS IN WHICH DISTANCE OF THE TEST FIELD AFFECTS DETERMINATIONS OF RETINAL SENSITIVITY*

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Determinations of achromatic and chromatic sensitivity are affected by such factors as breadth of pupil, size of test field, state of adaptation of the eye, brightness of the preexposure and surrounding field and distance of the test field. That the distance of the test object affects acuity has been at least fairly well known to ophthalmologists and workers in physiologic optics for many years, but that it has an important or considerable influence on retinal sensitivity has received little attention other than what is implied in the control and specification of distance as one of the conditions of work.

It would seem that the possibilities of change of distance of the object or stimulus influencing the intensity of the retina's response may be summed up in the following effects: change in the size of the image, change in the light density of the image and change in the distance of projection of the image.

CHANGE IN THE SIZE OF THE IMAGE

According to the laws of geometrical projection, when the size of the object is kept constant and its distance varied, the size of the image should vary inversely as the square of the distance of the object; when, however, the size of the object is changed by the amount required to keep the visual angle constant, the size of the image should remain the same. But in both of these cases the change in the refraction situation is a modifying factor; that is, with change of accommodation the position of the second principal refracting plane or second nodal point, whichever one chooses to take as the point of reference, is changed, which should cause a change in the size of the image. With increase of accommodation the distance of this plane from the retina should become greater and the size of the image increase, and with decrease of accommodation the distance should decrease and the image become smaller. Size of image is supposed to have an effect on the intensity of sensation, within

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certain limitations as to the range of change and position in the field, as well as on acuity. From this factor we might expect both acuity and sensory response to be affected by the distance of the object.

CHANGE IN THE LIGHT DENSITY OF THE IMAGE

Change in the distance of the object causes a change in the size of the pupil and a proportional change in the amount of light condensed into the image. The flux of light through the pupil varies as the square of its diameter. From this factor alone a very considerable effect of distance on intensity of sensation should be expected if provision is not made to keep this flux of light constant through the use of an artificial pupil or in some other way. The effect on the sensory response would come through a change in the intensity of the stimulation and through a change in the clearness of the image. According to the laws of geometrical projection there should be no change in the light density in the image with a constant size of pupil because both the intensity of light incident in the pupil and the size of the image vary inversely as the square of the distance of the object; i. e., these changes exert compensating effects on the density of light in the image. Assuming perfect diffusion, a compensating influence within the limits of the cosine effect is present also when the visual angle subtended by the object is held constant in making the change in distance; that is, in this case the intensity of light incident on the pupil from any point in the object varies inversely as the square of the distance, but the size of the object (the source of light, primary or secondary, and therefore the total amount of light emitted or reflected) varies directly as the square of the distance. This situation, however, is modified by the change in size of the image resulting from changes in accommodation as already noted.

CHANGE IN THE DISTANCE TO WHICH THE IMAGE IS PROJECTED

Change in the distance to which the image is projected is a possible psychologic factor and implies some relation between the intensity of sensation and the spatial magnitude of the projected image. As is well known, the apparent size of the image varies directly as the square of the distance to which it is projected. The question arises somewhat naturally, perhaps naively, does this spatial magnification, this spreading of the sensation over a larger surface, as it were, have an effect on its apparent intensity? If it does not, it so transcends all that is known of physical phenomena as to be another of the dualistic wonders of mind and matter that are so puzzling to workers in the borderline subjects. Our work on factors and their interaction would incline us to look for and expect more or less reciprocally an interplay or relativity between the spatial and sensory functions.

As long ago as 1914, two types of experiment were conducted by us on the effect of distance on the apparent brightness of objects. About this time somewhat exaggerated statements as to the independence of the apparent brightness of objects of any appreciable influence of distance were being made by certain photometrists engaged in the development of methods of measuring brightness. One of these wrote: "One of the most striking characteristics of brightness is that a bright surface is equally bright whether one views it at 1, 10 or 50 meters." In both types of experiment the determinations were made in a dark room with the eye dark-adapted for a period of thirty minutes. In the first type the threshold of achromatic sensitivity was determined for a surface of 45 sq. mm. at a distance of 1, 4, 7 and 10 meters. In the second type the end-point of the determination was a photometric balance or a judgment of equality of brightness. In this experiment surfaces of the same size were used as test fields. One, the standard surface, was kept at a fixed distance and held constant in brightness. The distance of the other was varied, and the density of light required to make it match the standard surface was determined for different distances. The match was made by successive judgments in order that changes in the size of the pupil with distance and other factors pertaining to the adjustment for distance would have due play. In both sets of experiments a strong but irregular effect of distance as a factor was found.

In 1912, determinations were made under our direction of the effect of distance on the value of the chromatic threshold. Pigment stimuli under light adaptation and filter stimuli under dark adaptation were used. In these experiments the visual angle subtended by the stimulus was held constant as the distance was varied through a range of from 1 to 14 meters. In the case of the pigment stimuli great care was taken to keep constant both the intensity of light incident on the stimulus and the state of adaptation of the eye of the observer. The effect of distance here also was to decrease the apparent intensity of the response. In all these experiments the conditions were planned to give full effect to all of the following factors: change of accommodation as influencing both the size of the image and the density of light in the image, change in the size of the pupil as influencing the density of light in the image and sharpness of imagery, and the distance to which the image was projected as a psychologic factor. No attempt was made to isolate the distance of projection of the image as a psychologic factor.

In 1911, a paper was published by us entitled "The Spatial Values of the Visual Field Immediately Surrounding the Blind Spot and the Question of the Associative Filling-In of the Blind Spot."[1] In the study described in this paper a narrow zone was found about the blind spot

1. Ferree, C. E., and Rand, G.: Am. J. Physiol. **29**:398, 1912.

in which space values were greatly magnified. We were concerned at this time to know whether this magnification of space values was a factor in the steepness of the sensitivity gradient immediately around the blind spot. As affording possible circumstantial evidence, other experiments were conducted in which subjective magnification of space value was produced in order to see whether in these cases, in which the amount of magnification could be subjected to variation and control, there was an effect of magnification on the intensity of the sensory response. One of the obvious ways of producing this magnification is the projection of the image to different distances. Either the positive image or the positive or negative after-image may be projected. The eye naturally projects the positive image to the distance of the object. Variation of distance of projection can be produced then by changing the distance of the object, as is the case if a threshold is obtained at different distances; or certain devices can be used to make the distance of projection greater than the distance of the object: (*a*) by looking beyond the object, as happens for example, when one looks between bars or through the meshes of a net or screen at some distant point; (*b*) by decreasing the angle of divergence of the rays of light entering the eye by means of a convex lens or a concave mirror, or (*c*) by decreasing the angle of convergence of the eyes by changing the placement of the images on the retina with prisms. As the most feasible of the foregoing methods we decided to use the projection of the negative after-image of a colored stimulus. The effect of projection on the intensity of the sensory response was obtained by determining for the different distances of projection the intensity of stimulating light that was required to give a just noticeable after-image. The stimulus surface was kept at a constant distance from the eye, and the after-images were projected successively in different sets of determinations to this distance and a series of greater distances. The time of stimulation was in all cases the same. The following conditions obtained in the experiments: (*a*) The distance of the object and the accommodation were always the same; therefore the size of image was always the same. (*b*) There was no effect of change of brightness of the stimulus on the size of the pupil; that is, the saturation of the color was varied to give the different values needed for the threshold without change in brightness. During the period of stimulation, therefore, the pupil can be regarded as always having had the same or approximately the same size, and the image formed on the retina as having had the same or approximately the same intensity or density of light. (*c*) The projection fields were all carefully matched in brightness. In order that there should be no variable effect in the brightness of the images formed by these projection surfaces due to change in the size of the pupil with accommodation, which would affect the intensity of the projected after-image of the

stimulus, the matching of brightness of these fields was made in successive judgments; that is, whatever variable effect was due to change of accommodation was taken account of in the visual act of matching. (*d*) The determinations were made in one of our specially lighted optics rooms. The intensity of illumination on the test object was 7 foot-candles, horizontal component. Supplementary illumination, variable as needed, was used for the illumination of the projection surfaces. The illumination was all of daylight composition and color. (*e*) The variable saturation of stimulus was obtained by combining on a color mixer a pigment sector with a sector of a gray of the brightness of the color. The color mixer could be swung out of the way in order to allow for the projection of the after-image without moving the eye. Several observers were used, and a number of determinations were made for each distance of projection of the image. Also the series was repeated for each observer on different days. A well marked effect of the distance of projection in the value of the after-image threshold was obtained. The amount of light required to arouse the after-image was found to increase as the distance of projection of the image was increased. This effect, we believe, was almost if not entirely free from any influence of change in the size of the image or in the density of light in the image; that is, it was almost, if not entirely an effect of the distance of projection of the image on its apparent intensity.[2]

There seems, then, in general to be an effect of distance as a factor in the determination of retinal responses, even when narrowed down to the distance of the projection of the image. Whether or not there is a differential effect for the different colors remains to be determined. Because we have recognized distance as a factor, we have endeavored to standardize the diagnostic work in perimetry for a given distance. In the case of our perimeter, for example, provision is made that the work on the arc and on the tangent screen shall both be done at the same distance. Diagnostic scales are compiled for this distance, and fields, blind spots, scotomas, etc., are all mapped at this distance. In the designing of the perimeter we have selected the distance that from all points of view we have considered the most feasible and satisfactory for practical work. Also we have devised methods that give much greater diagnostic sensitivity than was formerly obtained by working at greater distances than we have used, and in addition greater reproducibility of results and a better control of the conditions of the examination.

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2. Furthermore, it was reported by the observers employed in these experiments that when an after-image of threshold intensity for a distant projection had disappeared, it could be made to reappear by swinging in a near projection field. The greater part of the determinations of the effect of distance on the chromatic response, positive and negative, were made under our direction by Dr. Lorle I. Stecher, who was at that time a graduate student in our department.

Distance should be given consideration as a factor in determinations of sensitivity at the center of the field and in work on the perimeter and tangent screen. In this connection it would not be expected to be as important a factor in the determination of the limits of the field as in determinations of the threshold at the center and elsewhere in the field; or in scotometry because, owing to the steepness of the gradient of sensitivity in the peripheral portions of the field, it requires more effect to change the limits by a detectable amount than it does to change the threshold at any given point or the discriminable difference at the edge of a faint scotoma. As a matter of practical procedure, therefore, it is in the determinations of central and peripheral sensitivity for light and color and in the use of the tangent screen for comparative purposes at different distances that the effect of the factor has in particular to be looked out for and guarded against.

HOMATROPINE AND ATROPINE CYCLOPLEGIA

A COMPARATIVE STUDY *

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A review of the literature on refraction under cycloplegics has failed to reveal a comparative study of the value of these drugs, most authors limiting themselves to a statement that as a rule homatropine is used, but when a better cycloplegia is desired, and for children, atropine is the drug of choice.

Duane,[1] in 1908, said about homatropine:

> In the great majority of cases the findings with it are satisfactory, certain, and represent a full relaxation of the accommodation. In a few instances they are not. This is generally evident from the changing character of the subjective findings, the disagreement between these and the objective tests with skiascopy, and the persistence of a dioptry or so of accommodative power as measured by determining the difference between the near point and the far point when a convex glass is applied. In such cases atropine should be used. But even then it is not often that findings with atropine differ from those with homatropine, and in many cases, the difference is slight, not over 0.50 D. of hyperopia. And even with this, there may be in these cases, a residuum of accommodative power left, just as there was with homatropine.
>
> These cases that do not yield readily to homatropine and to atropine seem to occur particularly in patients between 40 and 45 years. They are, however, a rare exception and the rule is that homatropine, if properly used, is a satisfactory cycloplegia.

The report here submitted upholds some of Duane's contentions, but while the average in a large series of hyperopic eyes may vary only little over 0.50 diopter, the individual differences may often vary more than 2 diopters.

Duane made no mention of the difference in cases of myopia or mixed astigmatism, and we are able to show even greater differences in the changes produced by the two drugs in myopia or astigmatic patients than in hyperopic patients.

TECHNIC

The material here reported is from the private practice of Dr. E. V. L. Brown and myself, the Eye Clinic of the University of Illinois and

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* From the Department of Ophthalmology, the University of Chicago, Dr. E. V. L. Brown, director.

1. Duane: New York State J. Med. **8**:356, 1908.

the Max Epstein Clinic of the University of Chicago, so that it is of a diversified character in that it is representative of patients of all stratums of society in a midwestern metropolitan district (Chicago).

The eyes examined were treated as follows: A solution of 2 per cent homatropine hydrobromide was instilled into the conjunctival sacs every ten minutes for fifty minutes, and the refractive error was determined one hour from the time the first drop was instilled. The usual skiascopy with a concave mirror was done, a frosted globe with a 1¼ inch fenestra being used as the source of light, and all determinations were made at a distance of 1 meter from the patient's eyes.

The atropine sulphate solution of 1 per cent strength was used over a period of four and one-half days, the patient being instructed to use a drop before retiring on the first day, at meal time and bed time on the succeeding three days, and at breakfast and lunch time on the day of the examination. The patients seen at the clinics in the morning were given a drop one-half hour before the examination, so that all patients had a minimum of 14 drops of atropine at the time of the examination. All those cases in which the patient had missed more than 1 drop were excluded from the study.

To the criticism that I should have used the same amount of the drug in both series, I reply that I am studying the state of the refractive errors under the usual or accepted manner of administering these drugs. I will say that in a small percentage of cases in which the atropine was continued for longer periods of time, and in cases in which atropine was being used in treatment of diseased eyes not included in this series, the refractive error determined at the end of the fourteenth drop and that determined several days later were almost invariably the same.

The use of atropine in adults is, of course, annoying to the patient because of the duration of the cycloplegic effect. By treating one eye at a time this annoyance is partially avoided, in that most patients are able to continue their work while being tested. The patients are instructed to cover the atropinized eye while reading, and unless their work requires binocular depth perception (artists and surgeons) the annoyance is well tolerated. In patients whose occupation requires the use of both eyes, a + 200 or + 2.50 sphere in a hanger placed before the fully corrected refractive error allows even these patients to read or work with slight annoyance. A + 2.00 sphere added to only one eye under atropine is welcomed by some patients, but causes annoyance in others.

It is true that in a great many cases the slight overcorrection of myopia or the undercorrection of the hyperopia causes no serious damage to the eyes, and comparatively little annoyance to the patient. In high degrees of hyperopia, the undercorrection makes the patient more comfortable by allowing clearer distance vision and still makes him free from symptoms of eye strain when reading. In low degrees of hyperopia,

particularly in nervous patients who have much annoyance while reading, the full correction is essential to free the patient from symptoms of eye strain and allow him to work with comfort.

When doing the refraction under atropine, the figures for the previous homatropine test were not known, except perhaps in an occasional case in which the examiner remembered the finding of the week before. All cases in which the refraction was done under atropine more than three months after homatropine was used were omitted from the study as well as all cases in which there was any pathologic process in the refractive media, whether healed or active.

METHOD OF STUDY

For purposes of this study, the cases were grouped as follows: (1) hyperopia, (2) myopia and (3) mixed astigmatism. The first two groups were subdivided into the following age groups: (*A*) patients under 20 years of age (1 to 19 inclusive); (*B*) patients between 20 and 40 years of age (20 to 39 inclusive), and (*C*) those 40 or more years of age. These same two groups of cases were divided into the following three divisions according to the total refractive errors: (*a*) from 0.25 to 1.75 diopters, inclusive; (*b*) from 2.00 to 3.75 diopters, inclusive, and (*c*) more than 4 diopters of refractive error. The group of cases of mixed astigmatism was classified only according to the age of the patients.

I have nowhere indicated which patients were wearing glasses when first seen, and of that number, how many were wearing full correction, but it is my impression from the study of the last few hundred cases in the series that in those patients who were wearing glasses, especially those whose glasses approximated the full correction under atropine (most of the patients were over 40 years of age), there was less difference in the findings of the refractive errors under the two cycloplegics than in those patients who had never previously worn glasses.

I was impressed by the number of hyperopic patients who presented themselves wearing manifest corrections with minus lenses. It may be said to the credit of the ophthalmologists of this district that refraction in most of such cases had been determined by opticians.

DATA

The most significant findings are those tabulated in table 1, which shows that 7, or 2.1 per cent, of all myopic eyes became emmetropic under homatropine, and 22, or 9 per cent, of the myopic eyes became hyperopic under atropine; 29, or 12 per cent, of the myopic eyes showed mixed astigmatism under atropine, and 40 eyes, or 21 per cent, which showed mixed astigmatism under homatropine showed hyperopia under atropine. In other words, 98 eyes, or 0.77 per cent of the entire series, showed a change in the type of refractive error.

Table 2 is a compilation of the changes in each eye with respect to the balance of sphere and cylinders. Attention is first called to the fact that only 151 of 1,260 eyes, 129 of which were hyperopic, showed simple spheres under both drugs. Of the hyperopic eyes, 82, or 63 per cent, showed an increase in the amount of spheres; 37, or 28.6 per cent, showed no increase in the spheres, while only 10, or 7.7 per cent, showed less spheres under atropine than under homatropine. Of the myopic eyes, there were only 22 that remained simple spheres, and of these, 16, or 72.7 per cent, showed a weaker minus refractive error under atropine than under homatropine.

Excluding from the hyperopic eyes for the moment all the cases of plane spheres, one learns that of the 732 eyes that were astigmatic, 237, or 32.3 per cent, showed more spheres and less cylinder; 261, or 35.6, showed more cylinder, while 273, or 37.1 per cent, showed less cylin-

TABLE 1.—*Changes in the Type of Refractive Errors*

	Myopia to Emmetropia			Myopia to Mixed Astigmatism			Myopia to Hyperopia			Mixed Astigmatism to Hyperopia		
Groups.....	1	2	3	1	2	3	1	2	3	1	2	3
Number of cases....	1	6	0	1	23	5	6	13	3	7	27	6
Total.....	7			29			22			40		
	2.1%			12%			9%			21%		

der, the latter two without reference to whether the sphere remained the same, increased or decreased. The total of columns 3, 6, 7 and 8 in table 2 (562 eyes) represents 63.5 per cent of all the hyperopic eyes which showed the sphere increased, while the total of columns 4, 9, 10 and 11 (or 215 eyes) represents 24.5 per cent of all hyperopic eyes which had a decrease in the sphere.

The data in table 3 are grouped according to the total refractive errors under atropine and are divided into groups of cases of hyperopia, myopia and mixed astigmatism. Groups 1 include cases in which the refractive error varied from 0 to 1.75 diopters inclusive; groups 2, from 2 to 3.75 diopters inclusive, and groups 3, those with a refractive error over 4 diopters. The averages given in these tables are recorded in diopters. These averages represent the average increase for the meridians that showed an increase, and in the same manner, the average decrease for the meridians that showed a decrease under atropine. The significant figures are in the hyperopic groups, 1,070, or 62 per cent, of the total number of meridians that showed an average increase of 0.52 diopter. There were 151 meridians that increased over 0.75 diopter, and 112 meridians that increased 1 or more diopters. In other words, every sixth meridian in a hyperopic eye increased 0.75 or more diopters.

TABLE 2.—*Changes in the Total Refraction of Each Eye*

Group	Number of Eyes	More Sphere	Less Sphere	Same Sphere	More Sphere and Less Cylinder	More Sphere and More Cylinder	More Sphere and Same Cylinder	Less Sphere and Less Cylinder	Less Sphere and More Cylinder	Less Sphere and Same Cylinder	Same Sphere and More Cylinder	Same Sphere and Less Cylinder	Same Sphere and Same Cylinder
Hyperopia													
1	135	11	1	3	34	29	12	2	14	1	13	7	8
2	491	54	7	22	137	59	77	6	38	5	44	6	36
3	235	17	2	12	66	22	24	6	22	7	20	9	28
Myopia													
1	57	0	6	1	2	2	1	9	18	8	0	2	8
2	103	1	8	1	1	1	1	22	30	12	7	7	12
3	61	2	2	1	6	5	2	3	21	4	6	4	5
Mixed astigmatism	178	0	0	0	3 0.16%	40 22.4%	4 0.22%	32 17.97%	25 14.4%	20 11.2%	20 11.2%	10 5.6%	24 13.4%
Grand total	1,260	85	26	40	249	158	121	80	168	57	110	45	121
Total hyperopia	861	82 9.5%	10 0.76%	37 4.3%	237 27.55%	110 11.6%	113 11.9%	14 1.6%	74 8.0%	13 1.5%	77 8.6%	22 2.5%	72 8.0%
Total myopia	221	3 0.13%	16 7.6%	3 0.13%	9 0.4%	8 0.36%	4 0.18%	34 15.3%	69 31.2%	24 10.9%	13 5.8%	13 5.8%	25 11.3%

In the myopic groups shown in table 3 there were 265 of 442 meridians, or 59 per cent, that showed an average decrease of 0.61 diopter. Every seventh meridian in the myopic eye decreased 0.75 or more diopters. In the mixed astigmatism group, 206 of the 356 meridians, or 55 per cent, showed an increased hyperopia or a decreased myopia under atropine, the change averaging 0.53 diopter. Every fifth meridian showed a change of 0.75 or more diopters.

Table 4 is presented to show the changes in the foregoing age groups. There are (*A*) 861 hyperopic eyes, of which 135 are in patients under 20 years of age. This group shows the greatest amount of difference in the total refractions, having 178, or 65 per cent, of all meridians

TABLE 3.—*Average Changes of Total Refractive Error*

Groups	Meridians	Same	Decrease	Increase	+0.25	+0.50	+0.75	More Than +1.00	Average Increase	Average Decrease
Hyperopia										
1-2 D.	1,003	291	113	599	339	158	76	26	0.38 D.	
2-4 D.	468	109	53	306	112	99	51	44	0.53 D.	
Over 4 D.	251	52	32	167	44	57	24	42	0.66 D.	
Total	1,722	452	198	1,070	495	314	151	112	0.52 D.	
Myopia										
1-2 D.	234	67	135	32	83	35	14	3	.....	0.38 D.
2-4 D.	127	28	87	12	29	30	16	12	.....	0.59 D.
Over 4 D.	81	22	43	17	11	14	7	10	.....	1.13 D.
Total	442	117	265	61	123	79	37	25		0.7 D.
Mixed astigmatism										
Over 2 D.	128	35	20	73	30	19	8	16	0.54 D.	
Under 2 D.	228	61	34	133	56	32	17	28	0.53 D.	
Total	356	96	54	206	86	51	25	44	0.525 D.	

averaging an 0.88 diopter increase under atropine. The largest group (*B*), representing patients from 20 to 39 years of age, contains 982 meridians, 648, or 65 per cent, of which showed an average increase of 0.503 diopter. The last group (*C*) of hyperopic eyes, those of patients of 40 years or more of age, represents 470 meridians, 246, or 54 per cent, of which increased an average of 0.42 diopter. This last group contained most of the patients who had been wearing glasses approximating the full refractive error.

In the myopic cases, group *A* contains 114 meridians, 78, or 68 per cent, of which showed an average decrease of 0.51 diopter; group *B* contains 206 meridians, 130, or 63 per cent, of which had an average decrease of 0.43 diopter, and group *C*, 122 meridians, 51, or 41 per cent, of which showed an average decrease of 0.46 diopter.

In the cases of mixed astigmatism, group *A* has 54 meridians, 45, or 83 per cent, of which showed an increase, and 9, or 17 per cent, of which showed no change in any meridian. Group *B* has 154 meridians,

TABLES 4.—*Changes in Refraction of Age Groups A, B and C*

Group	Number of Cases	Number of Eyes	Meridian	Atropine > Homatropine	No Change	Atropine < Homatropine	Difference					Astigmatism With Rule		Less Cylinder	More Cylinder	Myopia to Hyperopia	Mixed Astigmatism to Hyperopia	Myopia to Mixed Astigmatism	Increase Hyperopia	Decrease Myopia	Myopia to Emmetropia	Increase Mixed Astigmatism
							+0.25	+0.50	+0.75	+1.00	Average	Homatropine	Atropine									
Hyperopia																						
A	84	135	270	178	57	35	54	50	32	42	>0.88 D.	91/100	89/ 98	43	56	6	7	1	93 68.8%	..	..	..
B	316	491	982	648	241	93	293	198	96	61	<0.503D.	259/326	279/351	149	141	13	27	23	338 68.8%	..	..	..
C	150	235	470	246	154	70	148	66	23	9	<0.42 D.	109/178	109/179	81	64	3	6	5	123 52.7%	..	..	..
Total	560	861	1,722	1,062	452	198	495	314	161	112	>0.6 D.	459/604	477/628	273	261	22	40	29	554 63.4%	..	..	..
Myopia																						
A	40	57	114	7	29	78	30	27	11	10	<0.51 D.	25/ 44	28/ 44	13	21	..	..	..	..	39 68.4%	1	..
B	63	103	206	20	51	130	62	42	21	10	<0.43 D.	34/ 58	35/ 56	33	38	..	..	..	..	65 63.1%	6	..
C	40	61	122	34	37	51	31	10	5	6	<0.46 D.	31/ 51	33/ 51	13	31	..	..	..	..	25 40.9%	0	..
Total	143	221	442	61	117	259	123	79	37	26	<0.46 D.	92/153	96/151	59	90	..	..	..	..	129 57.4%	7	..
Mixed astigmatism																						
A	24	27	54	45	9	0	16	5	6	18	>1.15 D.	21/ 27	20/ 27	3	20	..	7	1	..	..	..	23 81.5%
B	57	77	154	87	47	20	38	26	13	10	>0.54 D.	56/ 77	66/ 77	30	45	..	27	23	..	..	..	53 68.8%
C	60	74	148	74	40	34	32	20	6	16	>0.39 D.	58/ 74	52/ 74	10	20	..	6	5	..	..	..	50 67.5%
Total	141	178	356	206	96	54	86	51	25	44	>0.69 D.	135/178	159/178	45	85	..	40	29	..	..	..	126 72.0%
Grand total	844	1,260	2,520	1,329	665	511	704	444	223	182	>0.645D. <0.46 D.	586/935	728/957	377	436	22	40	29	.. 63.4%	129 57.4%	7	126 72.0%

87, or 56 per cent, of which showed an increase, while *C* has 148 meridians, 74, or 50 per cent, of which showed an increase under atropine. It will be seen at a glance that groups *A* in all three series show the highest percentage of change in meridians and the greatest average increase in diopters, while groups *C* in all series show the least change. Of the hyperopic eyes, there were 11.5 per cent of all meridians which showed an average of 0.23 diopter less plus under atropine; 13.7 per cent of the myopic meridians showed an average of 0.50 diopter more minus, and 15 per cent of the mixed astigmatism groups showed an average decrease of 0.41 diopter under atropine. We are unable to say whether this is or is not due to better relaxation under homatropine in a small percentage of cases. Attention is called to the figures showing the astigmatism with the rule being the case more often under atropine than under homatropine.

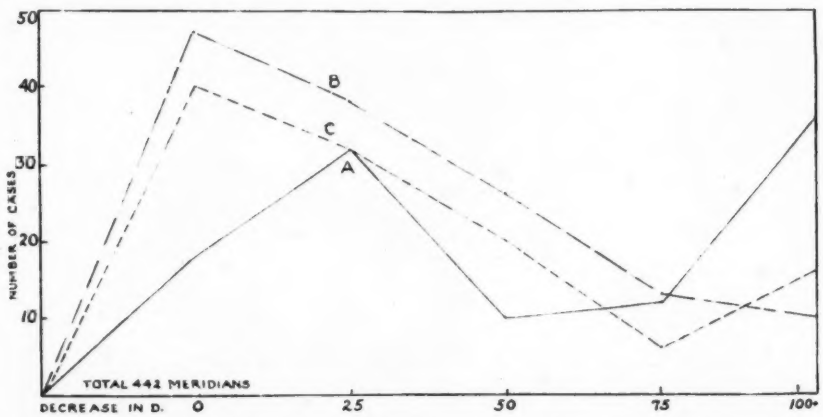

Chart 1.—Curves showing the decrease in diopters in myopic eyes under atropine. *A* indicates the curve for the patients from 1 to 19 years of age; *B*, for those from 20 to 39 years, and *C*, for those over 40.

Three charts are presented to show the results with both cycloplegics. The base line represents the findings with homatropine as only the differences are plotted. In all charts the abscissas represent the changes in diopters and the ordinates the number of meridians. Chart 1 shows the myopia in each of the groups, *A* representing meridians in patients from 1 to 19, *B* in patients from 20 to 39 and *C* in patients over 40 years of age. All figures for the group from 1 to 20 were multiplied by 2 to give approximately the same number of meridians in all groups. Chart 2 shows the curve for the cases of hyperopia and chart 3 a total curve of all the cases of hyperopia and myopia. In chart 2 the figures for the group from 1 to 20 years of age were multiplied by 4 and for the group over 40 by 2 in order to have the same number of meridians in all groups for comparison. In all charts the curves show an increase in the hyperopia and a decrease in the myopia.

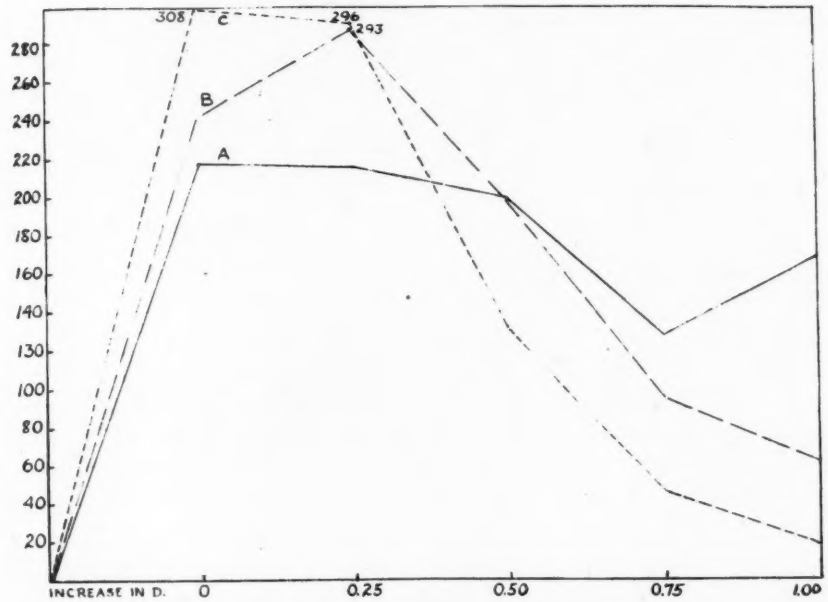

Chart 2.—Curves showing the increase in diopters in hyperopic eyes under atropine. *A* indicates the curve for the patients from 1 to 19 years of age; *B*, for those from 20 to 39 years, and *C*, for those over 40.

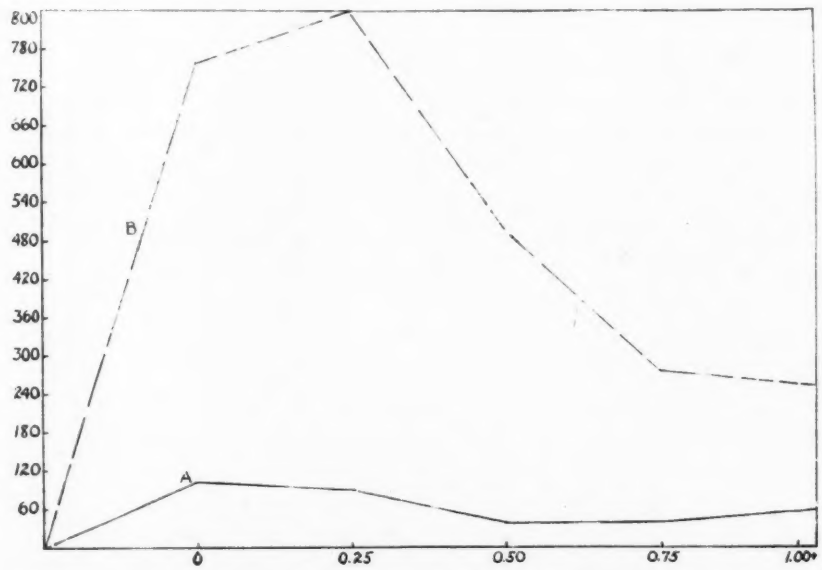

Chart 3.—Total of charts 1 and 2. *A* indicates the myopic curve and *B*, the hyperopic curve.

SUMMARY

Myopia.—Two and one-tenth per cent of all eyes that were myopic by homatropine determination became emmetropic; 12 per cent became mixed astigmatic, and 9 per cent hyperopic.

Of the patients under 20 years, 68.4 per cent showed less myopia; of those between 20 and 40 years, 63.1 per cent; and of those over 40 years, 40.9 per cent.

Of all the patients with myopia, 31.2 per cent showed a decrease in the sphere and an increase in the cylinder.

Of all myopic eyes, 59 per cent were reduced an average of 0.61 diopter.

Every seventh meridian was decreased by 0.75 diopter or more.

Hyperopia.—There is in 63 per cent an increase in the amount of plus sphere in all cases which remained simple spheres.

Of patients under 40 years, 68.8 per cent showed an increase in the hyperopia, while 52.7 per cent of all patients over 40 showed the same change.

Of all patients with compound hyperopic astigmatism, 32.3 per cent showed an increase in the sphere and a decrease in the cylinder.

Of all patients with hyperopia, 63.5 per cent showed an average increase of 0.6 diopter.

Every sixth meridian showed an increase of 0.75 diopter or more.

Mixed Astigmatism.—Twenty-one per cent of the cases under homatropine were hyperopic under atropine.

Fifty-five of all showed either a decrease in the sphere or an increase in the cylinder.

The most marked change occurred in patients under 20 years of age and the least in those over 40 years.

The largest average increase in hyperopia or decrease in myopia was seen in cases of over 4 diopters, and the smallest changes in cases of 2 diopters or less.

The mixed astigmatism group showed the most uniformity in all eyes and powers.

CONCLUSIONS

Atropine is a better cycloplegic than homatropine and should be used more in refraction, especially in myopia.

All cases with good unaided vision which accept weak minus corrections under homatropine should be refracted under atropine.

THE CORRECTION OF HIGH MYOPIA BY MUELLER'S CONTACT GLASSES*

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The drawbacks of common spectacles—the difficulty of correcting ametropia of the moving eye, the diminishing or magnifying effect of the spectacles, according to their distance from the eye, the frequent impossibility of wearing glasses of high power, the unsatisfactory cosmetic effect and their troublesomeness in some occupations—of necessity led, long ago, to the fundamental idea of the so-called contact glasses. These shell-shaped glasses are made up of two main portions, viz., the central corneal one for the correction of ametropia and the peripheral scleral one, which provides for the proper fitting of the glasses. The corneal portion of the contact glass represents in the air an afocal, i. e., a nonrefringent, optic system. When the contact glass is put on the eyeball, there collects—however closely the glasses may be fitted—a film of lacrimal fluid between the anterior surface of the natural cornea and the posterior face of the glass cornea, thus forming a kind of a liquid lens possessed of the same refractive index as the natural cornea. Thereby the natural cornea over which a contact glass is applied becomes optically inefficient. This results in a condition in which its irregularities are unable to interfere with vision. The idea of using contact glasses for correcting ametropia dates, as a matter of fact, back to as early as 1827, in which year Herschel reported the invention of these glasses. In 1879, Raehlmann used hyperbolically ground spectacles for correcting keratoconus. In cases of astigmatism due to scar formation Fick, in 1887, tried contact glasses which he had had ground by Zeiss at Jena. As early as 1888, he tried also to utilize the correcting effect of the contact glasses both in keratoconus and in irregular astigmatism, employing blown glass shells. In myopia it was A. Mueller who first tried this method, in 1889, correcting his own myopia of 14 diopters by contact glasses, but he could tolerate them for a short time only. This was true of the patients of Sulzer who, in 1892, had used ground contact glasses with good optical results. In the same year well ground contact glasses were made by Benoist and by Strueblin. In 1897, Lohnstein, and later Siegrist, had the hydrodiascope constructed for the correction of conical cornea. Siegrist afterward especially emphasized the possibility of using contact glasses for correcting ametropia. In 1912, Rohr and Stock suggested

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the use of ground contact glasses for subjective tests of spectacle effects. In 1913, Henker and Stock corrected ametropias with ground contact glasses manufactured by the firm of Zeiss.

From this time on, contact glasses were used by a number of oculists for the correction of visual acuity and for other therapeutic purposes as well as in all sorts of anomalies of the eyes. First of all, this kind of correction by contact glasses was adopted for persons with a conical cornea, and the early favorable reports were confirmed by many authors. Some of them used the ground contact glasses made by Zeiss, while others used the blown contact glasses made by M. Mueller. Thus Deutsch [1] reported the use of contact glasses in irregular astigmatism and high ametropia. He attempted optically to obtain improvement in cases of corneal macula, scars secondary to deep keratitis and conical cornea by means of contact glasses. In all cases he tried Zeiss' ground glasses, and in two cases only Mueller's blown glasses. His series included forty-nine patients (i. e., sixty-seven eyes). In twelve cases no improvement of visual acuity could be shown; in one case the vision obtained was 6/5, and in five cases 6/6. The best results were secured in cases of conical cornea and irregular astigmatism with slight opacities of the cornea. Proksch has used the contact glasses in all kinds of corneal anomalies showing irregularities of the anterior surface of the cornea, corneal scars, corneal dystrophy, primary degenerations of the cornea, descemetocele, chronic eczematous pannus and prominent degenerative nodules of the cornea, a conspicuous optical improvement being sometimes obtained. Dohme [2] made an attempt to correct conical cornea with Zeiss' ground glasses in six cases; visio of 5/50 was improved to 5/6. He was of the opinion that Zeiss' glasses are as well tolerated as Mueller's blown ones, as they had been worn by his patients uninterruptedly without any trouble for as long as five hours. He insisted, at the same time, on the possibility of longer tolerance for Mueller's contact glasses in conical cornea and on their improving the visual acuity and also having a good cosmetic effect. Lauber [3] succeeded in obtaining good visual acuity by contact glasses in corneal scars with irregular astigmatism, and his instructions were that the glasses should be worn at intervals. In a student with conical cornea the contact

1. Deutsch: Ueber die Verwendung von Kontaktgläsern bei irregulärem Astigmatismus und hoher Ammetropie, Klin. Monatsbl. f. Augenh. **82**:295, 1929.

2. Dohme: Die Korrektion des Keratoconus mit den geschliffenen Zeiss'schen Kontaktgläsern. Ztschr. f. Augenh. **48**:107, 1922; Zeiss'sche Kontaktgläser bei Keratoconus, Deutsche med. Wchnschr. **48**:1121, 1922.

3. Lauber: Kontaktgläser bei Keratoconus, Ophth. Gesellsch., Wien., Feb. 18, 1924; Sechs Jahre getragene Kontaktgläser bei Keratoconus, ibid., March 17, 1930.

glasses of Mueller improved vision that was equal to counting fingers at 2 meters to 6/12 and 6/10, respectively. This patient has worn the contact glasses on both eyes for six years. O'Rourke [4] succeeded in improving visual acuity in a case of conical cornea, also with the aid of a contact glass. Siegrist [5] and Stock [6] reported several successful cases, the latter author being of the opinion that blown contact glasses are better tolerated than the ground ones as they are devoid of sharp edges. A patient of Scheffels [7] with bilateral conical cornea wore Mueller's blown contact glasses for four years without annoyance. In seventeen cases of conical cornea Dallos [8] was able to obtain improvement in visual acuity, and his patients tolerated the contact glasses well. Oblath [9] stressed the improvement of all refractive errors by ground contact glasses. Beaumont [10] obtained improvement in visual acuity by contact glasses in astigmatism of as much as 18 diopters in which correction by cylinder glasses had proved a failure. When the contact glasses were applied over the corneas, astigmatism could not be detected by either the ophthalmometer or retinoscopy. Weihmann [11] recommended the use of transparent contact glasses in order to avoid dressings for corneal ulcers and epithelial defects, and Ascher [12] felt that the wearing of circularly tinted contact glasses is indicated in albinism. Heine [13] undertook the correction of all ametropias by the aid of ground contact glasses on a larger scale. He made attempts to correct refractive errors up to + 15 and — 20 diopters through contact glasses. He recommended, too, the use of contact glasses for hyperopia

4. O'Rourke, Donald: The Optical Correction of Conical Cornea with a Contact Glass, Am. J. Ophth. **12**:187, 1929.

5. Siegrist: Zur Anwendung der Kontaktgläser bei Keratokonus, Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch. **42**:340, 1920.

6. Stock: Neue Formen von Kontakgläsern bei Keratokonus, Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch., Aug. 5, 1920, vol. 42.

7. Scheffels: Doppelseitiger Keratokonus der seit vier Jahren Mueller'sche Kontaktgläser ohne Beschwerden trägt, Ver. Rheinisch-Westphäl. Augenärzte, 1925.

8. Dallos: Ueber die Kontaktschalen, Hung. Ophth. Soc., Nov. 29, 1929.

9. Oblath: Die Verbesserung aller Refraktionsanomalien mit geschliffenen Kontakgläsern, Boll. ocul. **9**:744 (Aug.) 1930.

10. Beaumont: Contact Glasses for High Astigmatism, Proc. Roy. Soc. Med. **24**:171 (Dec.) 1930.

11. Weihmann: Verbandlose Behandlung von Ulcus Corneae und Epitheldefekten mit durchsichtigen Kontaktschalen, Klin. Monatsbl. f. Augenh. **70**:237, 1923.

12. Ascher: Ringförmig gefärbte Kontaktgläser bei Albinismus, Klin. Monatsbl. f. Augenh. **85**:829, 1930.

13. Heine: Die Korrektur sämtlicher Ammetropien durch geschliffene Kontaktgläser, Thirteenth International Ophthalmological Congress, 1929; abstr., Arch. Ophth. **4**:131 (July) 1930.

due to aphakia caused by an operation for cataract. Hartinger [14] also tried to improve impaired vision by means of Zeiss' ground contact glasses. He was also successful in correcting aphakic eyes in this manner.

The attempts to use contact glasses for diagnostic purposes are interesting. Thus, according to Aust,[15] astigmatism can be eliminated by means of contact glasses while the eyegrounds of astigmatic eyes are being photographed. The contact glass also makes easy ophthalmoscopy with the erect image when the eye under examination has a high astigmatism. Ohm recommended for the observation of nystagmus the use of contact glasses made opaque by black gum-lac; when applied over the cornea they take part in any movement of the globe, even with optokinetic nystagmus.

The correction of high myopia by means of contact glasses has already been suggested by several authors. Loehlein stressed that in high myopia associated with astigmatism good vision can be obtained by means of contact glasses. Procksch [16] obtained good results with contact glasses in myopic hunters and ski-runners; also in persons afflicted with high myopia who did not tolerate correction by common spectacles. In this respect Clausen [17] had favorable experiences with Mueller's blown contact glasses, which were tolerated well during the entire day. Thus he was able to obtain improvement in visual acuity up to 5/7, 5/6 and 5/5. Deutsch [18] undertook to correct myopia (right eye, —22 diopters; left eye, —7 diopters) in an opera singer by contact glasses; he succeeded in obtaining a correction up to 6/6 by the glasses, which the patient always wore on the stage. Zeiss' contact glasses were tolerated by the patient for only two or three hours, whereas he could wear Mueller's glasses for a much longer time. The experiences of Kraemer with contact glasses were also favorable. He reported cases in which Zeiss' ground glasses were not tolerated in contrast to good results with Mueller's blown glasses.

14. Hartinger: Zur Berichtigung der Fehlsichtigkeiten mittels der geschliffenen Zeissischen Haftgläser, Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch. **48**:189, 1930; Ueber Haftgläser vom optischen Standpunkt, Ver. Rheinisch-Westphäl. Augenärzte, March 23, 1930; Zur Haftglasberichtigung linsenloser Augen, Ver. mitteldeutscher Augenärzte, Aug. 30, 1930.

15. Aust: Ueber einige weitere Arten der Verwendung der Kontaktgläser, Klin. Monatsbl. f. Augenh. **82**:535, 1929.

16. Procksch: Die Verwendung von Kontaktgläsern bei Hornhautnarben, Ophth. Gesellsch., Wien., Dec. 12, 1927.

17. Clausen: Günstige Erfahrungen mit Müllerschen Kontaktschalen, Klin. Monatsbl. f. Augenh. **82**:112, 1929.

18. Deutsch: Praktische Durchführung von Myopiekorrektion mit Kontaktgläsern, Klin. Monatsbl. f. Augenh. **82**:524, 1929.

Dallos [19] expressed the opinion that a contact glass designed to correct myopia ought to have a flat corneal portion but a stronger scleral curvature, for otherwise the glass would not remain fixed. He had the firm of Zeiss make glasses with three faces, namely, with a central optically active correcting face and with an intermediate face which lay between the glass cornea and the glass sclera and supported the glass cornea. The correction of high myopia with a glass of from 18 to 28 diopters resulted in an improvement averaging 1.4 times the vision before correction.

Thus, by means of contact glasses an improvement in visual acuity has been obtained to a large extent in all sorts of ocular defects, including myopia. Some authors have employed Zeiss' ground contact glasses; others, Mueller's blown contact glasses. Some of them have reported better results with Zeiss' glasses; others with Mueller's. It is at present an open question which of the two glasses is better for practical purposes. To my way of thinking, indications and individualization will not fail to secure a suitable field of application for both forms. My experiments on the improvement of visual acuity by contact glasses refer to Mueller's blown contact glasses, especially to their usefulness in the correction of high myopia.

The results of my experiments are shown by the accompanying table. I tried Mueller's contact glasses systematically in thirty-eight cases of high myopia, irrespective of sex, age and profession, being governed in the selection of my test material only by the degree of myopia and the insufficient correction of the ametropia by common spectacles. The patients had, for the most part, an intellectual occupation or were handicraftsmen, and hence were prompted to seek better vision for their work. The contact glass was tried in seventeen females and twenty-one males. The youngest of the selected patients was 10 years old and the oldest 63; most of them were between 20 and 40 years of age. Profession, sex and age, therefore, played no part in the decision as to whether or not the contact glass should be given a trial. It is only individual nervous and local ocular disturbances that interfere with their being worn. In my experiments the degree of myopia was for the most part more than 10 diopters, in one case being more than 30 diopters. Most of the patients were affected with anisometropia, and often the myopia was associated with regular astigmatism. When there was a coexistence of corneal scars and myopia, there was also irregular astigmatism. Of the thirty-eight patients, twenty-four also suffered from astigmatism. The difference in anisometropia was 6 diopters (case 1), 7 diopters (cases 18 and 25), 8 diopters (case 2)

19. Dallos: Korrektion hochgradiger Myopie durch Haftgläser mit drei Flächen, Hung. Ophth. Soc., June 28, 1930.

Improvement in Vision Obtained by Contact Glasses in High Myopia

Case; Patient	Occupation	Age, Years; Sex	Refraction	Vision Uncorrected	Vision Corrected by Common Spectacles	Vision Corrected by Contact Glasses	Eyeground	Length of Time Contact Glasses Were Worn	Comment
1 H. O.	Tailoress	25 F	Right: 12 D Left: 18 D	Right: fingers at 2 meters Left: fingers at 0.5 meters	Right: —8 D sph., 5/30 Left: —16 D sph., 5/70	Right: 5/10 Left: 5/15	Areas of strong pigmentary degeneration in the macula, on both sides	Test period 7 weeks	
2 K. E.	Employer	35 M	Right: —14 D Left: —22 D	Right: fingers at 2 meters Left: fingers at 1 meter	Right: —14 D sph., 5/15 Left: —15 D sph., 5/20	Right: 5/10 Left: 5/10	Parapapillary choroidal atrophy of both eyes	Test period 9 weeks	
3 S. E.	Student	15 F	Right: —13 D hor. axis; —9 D vert. axis Left: —12 D hor. axis; —8 D vert. axis	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —9 D sph. ⊃ —4 cyl. axis 90, 5/30 Left: —8 D sph. ⊃ —4 cyl. axis 90, 5/30	Right: 5/7 Left: 5/10	Slight myopia choroiditis of both eyes	Test period 3 months	Divergent squint of both eyes
4 M. M.	Wife of attorney	30 F	Right: —9 D hor. axis; —11 D vert. axis Left: —7 D hor. axis; —9 D vert. axis	Right: fingers at 3 meters Left: fingers at 2 meters	Right: —9 D sph. ⊃ —2 cyl. axis 180, 5/7 Left: —7 D sph. ⊃ —2 cyl. axis 180, 5/7	Right: 5/20 Left: 5/15	Myopic conus	Test period 3 days	
5 B. J.	Merchant	17 M	Right: —10 D Left: —10 D	Right: fingers at 4 meters Left: fingers at 4 meters	Right: —10 D sph., 5/50 Left: —10 D sph., 5/50	Right: 5/7 Left: 5/7 ?	.....	Test period 8 weeks	Superficial corneal scars; irregular astigmatism following phlyctenular keratoconjunctivitis 12 years before
6 C. J.	Employer	20 M	Right: —11 D hor. axis; —13 D vert. axis Left: —10 D hor. axis; —12 D vert. axis	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —10 D sph., 5/20 Left: —9 D sph., 5/20	Right: 5/10 Left: 5/10	.....	Test period 6 weeks	
7 N. E.	Minister	29 M	Right: —10 D hor. axis; —7.5 D vert. axis Left: —10 D hor. axis; —7.5 D vert. axis	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —7.5 D sph. ⊃ —2.5 cyl. axis 90, 5/15 ? Left: —7.5 D sph. ⊃ —2.5 cyl. axis 90, 5/15 ?	Right: 5/7 Left: 5/5 ?	.....	Test period 12 weeks	

8 P. J.	Student	17 M	Right: —9 D Left: —9 D	Right: hand movements Left: fingers at 1 meter	Right: —9 D sph., fingers at 4 meters Left: —9 D sph., 5/15	Right: 5/20 Left: 5/10	.....	Test period 12 weeks	Corneal scars and slight irregular astigmatism
9 B. M.	Upholsterer	19 M	Right: —14 D hor. axis; —18 D vert. axis	Right: fingers at 0.5 meter	Right: —14 D sph. ⊃ —4 cyl. axis 90, 5/70	Right: 5/20	.....	In use for 6 months; irritation of conjunctiva with deep pits	Phthisis bulbi of the left eye; corneal scars and irregular astigmatism of the right eye
10 S. J.	Employer	32 F	Right: —12 D hor. axis; —14 D vert. axis Left: —10 D hor. axis; —14 D vert. axis	Right: fingers at 12 meters Left: fingers at 2 meters	Right: —10 D sph. ⊃ —2 cyl. axis 180, 5/10 Left: —8 D sph. ⊃ —2 cyl. axis 180, 5/7	Right: 5/10 Left: 5/10	.....	Test period 4 months	Reads better with contact glasses; has no trouble
11 P. J.	Teacher	25 F	Right: —1.5 D Left: —16 D hor. axis; —21 D vert. axis	Right: 5/15 Left: fingers at 1 meter	Right: —1.5 D sph., 5/5 Left: —14 D sph. ⊃ —4 cyl. axis 180, 5/30	..... Left: 5/10	.....	Test period 8 weeks	Binocular vision produced by wearing contact glass on one eye
12 S. R.	Peasant's daughter	10 F	Right: —11 D hor. axis; —9 D vert. axis Left: —7 D hor. axis; —3 D vert. axis	Right: fingers at 2 meters Left: fingers at 4 meters	No correction	Right: 5/50 Left: 5/30 ?	Myopic choroiditis	Test period 10 weeks	Central corneal scars on both eyes; concomitant divergent strabismus of both eyes
13 S. T.	University professor	36 M	Right: —7 D hor. axis; —8 D vert. axis Left: —7 D hor. axis; —8 D vert. axis	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —7 D sph. ⊃ —0.75 cyl. axis 180, 5/5 Left: —7 D sph. ⊃ —0.75 cyl. axis 180, 5/5	Right: 5/10 Left: 5/15	.....	Test period 4 days	
14 V. B.	Student	15 M	Right: —16 D hor. axis; —14 D vert. axis Left: —15 D hor. axis; —13 D vert. axis	Right: fingers at 2 meters Left: fingers at 1 meter	Right: —14 D sph. ⊃ —2 cyl. axis 90, 5/5 Left: —13 D sph. ⊃ —2 cyl. axis 90, 5/7	Right: 5/7 Left: 5/7	.....	3 weeks	
15 C. J.	Operator	16 F	Right: —14 D hor. axis; —16 D vert. axis Left: —10 D hor. axis; —12 D vert. axis	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —11 D sph. , 5/15 (?) Left: —10 D sph.,5/20	Right: 5/7 Left: 5/10 ?	Peripapillary choroidal atrophy and areas of diffuse depigmentation in both eyes	2 weeks	

Improvement in Vision Obtained by Contact Glasses in High Myopia—Continued

Case; Patient	Occupation	Age, Years; Sex	Refraction	Vision Uncorrected	Vision Corrected by Common Spectacles	Vision Corrected by Contact Glasses	Eyeground	Length of Time Contact Glasses Were Worn	Comment
16 K. E.	Employer	58 M	Right: —14 D hor. axis; —13 D vert. axis	Right: fingers at 1 meter	Right: —13 D sph. ⊃ —1 cyl. axis 90, 5/5	Right: 5/7	.....	Trial lenses 10 weeks	In spite of the weaker correction, he prefers the contact glasses
			Left: —14 D hor. axis; —13 D vert. axis	Left: fingers at 1 meter	Left: —13 D sph. ⊃ —1 cyl. axis 90, 5/5	Left: 5/7			
17 M. H.	Teacher	22 M	Right: —8 D	Right: fingers at 4 meters	Right: —8 D sph., 5/5	Right: 5/10	.....	Trial lenses 8 days	Slight muscular insufficiency; he reads better with contact glasses
			Left: —8 D	Left: fingers at 4 meters	Left: —8 D sph., 5/5	Left: 5/10			
18 F. J.	Grocer	29 M	Right: —10 D	Right: fingers at 1 meter	Right: —10 D sph., fingers at 3 meters	Right: 5/10	.....	Trial lenses 3 weeks	Corneal scars after parenchymatous keratitis sustained 21 years before
			Left: —8 D	Left: 5/50	Left: —3 D sph., 5/15	Left: 5/10			
19 D. J.	Peasant	18 M	Right: —16 D	Right: fingers at 1.5 meters	Right: —16 D sph., 5/50	Right: 5/7	Peripapillary choroidal atrophy	Trial lenses 12 weeks	
			Left: —18 D	Left: fingers at 1 meter	Left: —18 D sph., 5/70	Left: 5/10			
20 B. B.	Veterinary surgeon	51 M	Right: —12 D	Right: fingers at 0.5 meter	Right: —12 D sph., 5/50	.....	.....	Trial lenses 5 days	The single contact glass was well tolerated; binocular vision could not be achieved
			Left: +2 D hor. axis; +1 D vert. axis	Left: 5/20	Left: +1 D sph. ⊃ +0.75 cyl. axis 90, 5/5	Left: 5/15			
21 B. J.	Engineer	31 M	Right: —10 D obl. axis quad. I-III, and —8 D obl. axis quad. II-IV	Right: fingers at 1.5 meters	Right: —8 D sph. ⊃ —1.5 cyl. obl. axis quad. II-IV, 5/50	Right: 5/5	.....	Single glass for practical use 6 months	
			Left: —10 D obl. axis quad. I-III, and —12 D obl. axis quad. II-IV	Left: fingers at 1 meter	Left: —10 D sph. ⊃ —1.5 cyl. obl. axis quad. I-III, 5/30	Left: 5/7 ?			
22 D. L.	Student	20 M	Right: —12 D hor. axis; —14 D vert. axis	Right: fingers at 2 meters	Right: —12 D sph. ⊃ —2 cyl. axis 180, 5/15	Right: 5/7	.....	Trial lenses 3½ months	Wears the contact glasses throughout the day, without annoyance; reads the smallest types
			Left: —10 D hor. axis; —12 D vert. axis	Left: fingers at 3 meters	Left: —10 D sph. ⊃ —2 cyl. axis 180, 5/15	Left: 5/7			
23 G. R.	Dental assistant	17 F	Right: —17 D hor. axis; —18 D vert. axis	Right: fingers at 2 meters	Right: —10 D sph., 5/50	Right: 5/30	.....	Trial lenses 6 days	
			Left: —14 D hor. axis; —18 D vert. axis	Left: fingers at 1.5 meters	Left: —10 D sph., 5/70	Left: 5/30 ?			

24 O. K.	Nun	46 F	Right: —30 D hor. axis; —34 D vert. axis Left: —24 D hor. axis; —28 D vert. axis	Right: hand movements Left: fingers at 1.5 meters	Right: —20 D sph., fingers at 1 meter Left: —20 D sph., 5/20 (?)	Right: 5/30 Left: 5/10	Peripapillary and macular atrophy of the choroid	Trial lenses 3 weeks	Common spectacles are not tolerated
25 J. B.	Merchant	20 M	Right: —1 D Left: —8 D	Right: 5/10 Left: fingers at 3 meters	Right: —1 D sph., 5/5 Left: —8 D sph., 5/15	..... Left: 5/15	.....	Trial lens 4 days	Binocular vision is at times reached with the single contact glass
26 M. R.	Merchant's daughter	22 F	Right: —14 D hor. axis; —18 D vert. axis Left: —14 D hor. axis; —18 D vert. axis	Right: fingers at 2 meters Left: fingers at 2 meters	Right: —12 D sph. ⊂ —2 cyl. axis 180, 5/50 Left: —12 D sph. ⊂ —2 cyl. axis 180, 5/50	Right: fingers at 3 meters Left: fingers at 3 meters	.....	Trial lenses tolerated for half an hour at the most	Anemic, extremely nervous patient
27 L. T.	Teacher	47 F	Right: —8 D Left: —4 D	Right: fingers at 3 meters Left: 5/50	Right: —8 D sph., 5/30 Left: —4 D sph., 5/7 (?)	Right: fingers at 4 meters Left: 5/30	Central myopic choroiditis	Trial lenses tolerated for no more than one hour	
28 F. G.	Employee	50 F	Right: —10 D hor. axis; —7 D vert. axis Left: —14 D	Right: fingers at 2 meters Left: fingers at 0.5 meter	Right: —7 D sph ⊂ —3 cyl. axis 90, 5/7 Left: —14 D sph., 5/30	Right: 5/7 Left: 5/10	Pigmented lesions of the macula	Trial lenses (5 days) tolerated for only half an hour daily	
29 L. J.	Cook	30 F	Right: —5 D obl. axis quad. I-III and —6.5 D obl. axis quad. II-IV Left: —4 D obl. axis quad. I-III and —6 D obl. axis quad. II-IV	Right: fingers at 1 meter Left: fingers at 1 meter	Right: —5 D sph. ⊂ —1.5 cyl. obl. axis quad. I-III, 5/70 Left: —4 D sph. ⊂ —1.5 cyl. obl. axis quad. I-III, fingers at 2 meters	Right: 5/20 Left: 5/30	.....	Trial lenses 3 weeks	Extensive corneal scars following eczematous keratoconjunctivitis sustained 15 years before
30 S. G.	Shoemaker's wife	39 F	Right: —16 D Left: —16 D	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —16 D sph., 5/15 Left: —16 D sph., 5/15	Right: 5/10 Left: 5/7	.....	Trial lenses 3 weeks	
31 M. A.	Landed proprietor	22 M	Right: —11 D hor. axis; —10 D vert. axis Left: —9 D	Right: fingers at 3 meters Left: fingers at 3 meters	Right: —10 D sph., 5/20 (?) Left: —9 D sph., 5/20 (?)	Right: 5/12 ? Left: 5/15 ?	Myopic lesions of the macula	Trial lenses 10 days	
32 S. B.	Barber	30 M	Right: —19 D hor. axis; —16 D vert. axis Left: —20 D hor. axis; —17 D vert. axis	Right: fingers at 0.5 meter Left: fingers at 0.5 meter	Right: —16 D sph., 5/30 Left: —16 D sph., 5/30 (?)	Right: 5/10 Left: 5/15	.....	Trial lenses 2 weeks	

Improvement in Vision Obtained by Contact Glasses in High Myopia—Continued

Case; Patient	Occupation	Age, Years; Sex	Refraction	Vision Uncorrected	Vision Corrected by Common Spectacles	Vision Corrected by Contact Glasses	Eyeground	Length of Time Contact Glasses Were Worn	Comment
33 A. E.	Student	17 F	Right: —13 D	Right: fingers at 2 meters	Right: —13 D sph., 5/30	Right: 5/15	.....	Trial lenses 2 weeks	Central thin corneal scars on both eyes, with slight irregular astigmatism
			Left: —13 D	Left: fingers at 3 meters	Left: —13 D sph., 5/20	Left: 5/7			
34 G. J.	Merchant	63 M	Right: —10 D	Right: fingers at 0.5 meter	Right: —10 D sph., 5/70	Right: 5/70	Central choroidal atrophy of both eyes	Trial lenses 3 days	
			Left: —10 D	Left: fingers at 0.5 meter	Left: —10 D sph., fingers at 4 meters	Left: 5/70			
35 G. A.	Cook	62 F	Right: —18 D hor. axis; —16 D vert. axis	Right: fingers at 3 meters	Right: —15 D sph., 5/20 (?)	Right: 5/10	.....	Trial lenses 8 days	
			Left: —16 D hor. axis; —14 D vert. axis	Left: fingers at 3 meters	Left: —14 D sph., 5/10 (?)	Left: 5/10			
36 Z. K.	Merchant	30 M	Right: —8 D	Right: fingers at 2 meters	Right: —8 D sph., fingers at 3 meters	Right: fingers at 3 meters	.....	Trial lens 1 hour	Congenital buphthalmos and central corneal opacity of right globe; phthisis bulbi of left globe; patient does not tolerate the contact glass
37 N. S.	Agricultural laborer	26 M	Right: —15 D hor. axis; —10 D vert. axis	Right: fingers at 2 meters	Right: fingers at 2 meters	Right: 5/7	.....	Trial lenses 14 wk. (pearly epithelial vesicles on the cornea)	Transitory diplopia of only short duration
			Left: —15 D hor. axis; —10 D vert. axis	Left: fingers at 3 meters	Left: fingers at 3 meters	Left: 5/5 ?			
38 B. J.	Tailoress	19 F	Right: high irregular astigmatism Left: emmetropia	Right: fingers at 0.5 meter Left: 5/5	Right: not correctable	Right: 5/7	.....	Trial lens 4 weeks	Corneal scars on the right eye after deep keratitis sustained 12 years before; concomitant divergent squint of both eyes

and 15 diopters (case 11). In all of the cases visual acuity without correction was poor, which can at once be explained by a high degree of myopia, astigmatism, changes in the fundi (in several cases) and corneal opacities. Perception of fingers at 0.5 meter and at from 2 to 3 meters was the common visual acuity in my cases. With suitable correction a fairly serviceable visual acuity is, of course, often obtainable by the examiner after long and hard work, but many patients are not contented with it. Often the necessary correction with glasses of higher power is not tolerated even for a short period of time, cephalea, vertigo and even nausea interfering with their use. For obvious reasons the achievement of a satisfactory correction must, of necessity, fail in cases showing alterations of the eyeground or scars of the cornea. Thus twelve of my patients had alterations of the eyeground, and in nine the aforementioned corneal scars were found, which, of course, are the greatest hindrances to a correction with common glasses. In many cases satisfactory improvement in visual acuity was obtained; there were even many instances in which better vision was obtained than by common spectacles; in several cases in which common spectacles failed to yield correction, good vision was obtained by contact glasses. There were also cases in which common spectacles had produced the corresponding correction, but could not be worn. The cases of astigmatism yielded relatively good optical results with contact glasses (see table). Cases showing corneal scars proved to respond best of all to correction by means of contact glasses as compared with correction by common spectacles. Improvement in visual acuteness was noted in many of my thirty-eight cases: in several cases from 5/70 to 5/7 or even to 5/5. The most illustrative examples are: case 21, in which after protracted use of the contact glasses the visual acuity of an engineer rose to 5/7 and 5/5, respectively, and the glasses were tolerated excellently; case 22, in which visual acuity increased to 5/7 in both eyes, and case 38, in which correction of vision to 5/7 was obtained in a young girl who since childhood had had corneal scars and high myopic irregular astigmatism in one eye with perception of fingers at 0.5 meter. I also have cases on record in which it was not possible to obtain a better acuity of vision than that afforded by common spectacles, and cases in which the correction obtained by contact glasses was even worse, as can be seen in the table. There were also cases in which the contact glass could not be tolerated, even for a short period. Nor could contact glasses enhance visual acuity to a corresponding degree in patients with lesions of the eyegrounds. I have tried contact glasses in all of my cases, except two. The patients wore the contact glasses for from one to several weeks, some of them even for two or three months, so that the value of the contact glasses could be appreciated in every respect (optically, haptically, etc.). On account

of the novelty of the contact glasses the patients have not yet been able to familiarize themselves with the idea of continuing to wear them, and thus far it has been hard to induce any one to obtain contact glasses for practical use. The price also plays a rôle. I hope, however, that gradually all of my patients to whom the use of contact glasses has proved an optical advantage will be persuaded to purchase them. I have two such patients who bought the contact glasses and have had them in practical use for more than half a year.

PRACTICAL UTILITY OF MUELLER'S CONTACT GLASSES

On the basis of my experience, the practical utility of Mueller's contact glasses can best be judged by considering the correction of high myopia from the following points of view: the optical, the haptic (tolerance for the glasses, potential injury to the eye by protracted use of the glasses), the physiologic (motility of the eyes, stereoscopic vision, influence on accommodation), the cosmetic, the psychologic and especially the therapeutic.

The optical utility of Mueller's contact glasses can be learned from the table at the first glance. Improvement in vision resulted in many of the cases in which common spectacles had been able to produce only a modest improvement. The cases that I selected for my experiments were such as had not drawn the hoped for benefit from common spectacles, and in which good acuity of vision could have been reached by common spectacles, in spite of the presence of high myopia, but for the impossibility of tolerating them because of vertigo, micropsia, etc., due to their high refractive power. In these cases I was often surprised not only at the good optical result achieved by the contact glasses, but at the ease with which they were tolerated from the first moment. When one prescribes Mueller's contact glasses, the adequate glass has to be selected from a fairly large number by thorough trials, since the exact radius of curvature desired is hard to obtain. Therefore it is necessary to try the glasses for a considerable time and in large numbers until the convenient optical correction is reached; in return, however, one is afforded the satisfaction of seeing that the optically suitable glass selected with much trouble and patience can really be worn. It is necessary to choose the proper glass empirically from a large number of glasses. Each new glass has to be chosen in this manner and tried. With Zeiss' contact glasses only the exact fit of the glasses has to be considered at the trial, because the necessary shape and indexes of refraction will be provided for practical use, as prescribed by the physician. According to the statement of some authors, however, at times difficulties arise from the haptic point of view. With Mueller's contact glasses the optical effect must also be taken into account at the selection

of the trial lens. I have, however, observed that the optical effect improved spontaneously after Mueller's glasses had been worn for some days, probably owing to better adaptation of the glasses to the eyes. With Mueller's contact glasses full correction of the acuity of vision ought to be attempted at the time the glasses are selected. Further correction by augmentation of the refractive power is difficult, because the glasses are manufactured by blowing. At times it happens that a still higher degree of visual acuity can be obtained by placing spectacles before the contact glasses when the suitable trial glass has been determined. This supplementary refractive power—which, for the most part, ranges only from 2 to 3 diopters—is, as far as is practicable, added by the firm when manufacturing the contact glasses for definitive use. In one case glasses manufactured in this way yielded an excellent optical effect.

The procedure that I use at the selection of the trial lens is as follows: After having put in order according to their size all the contact glasses at my disposal—preferably marking in millimeters the length and width of the glasses—and after having accurately tested them ophthalmometrically and marked their refraction, I choose for the first trial those glasses which have a spherical shape most nearly approaching that of the cornea and which are likely to match the eye best in regard to the size and curvature of the glass sclera. At the following trials I begin the application of glass corneas, which are tried in increasing order of flatness at several sittings successively, with a view to obtaining the best visual acuity. It is better to give a trial every day with only two contact glasses and to keep a record of the acuteness of vision, because otherwise the patient becomes tired and is not aware of improvement in visual acuity; secondly, the eye has already been so irritated by the manipulations with the two trial lenses that it begins winking, making it impossible to determine the acuteness of vision. In those cases in which there is high myopia and common spectacles give good visual acuity, yet strong glasses cannot be tolerated by the patient, I have suggested the wearing of contact glasses also, provided that the same visual acuity is obtained as with common spectacles. In my cases those contact glasses which had given good visual acuity for distant vision also proved suitable for close work, reading and writing. When a glass other than that for far vision was suitable for reading, I preferred having this glass used also for far vision. Astigmatic effects are known not to be susceptible of being conferred to contact glasses, because these are movable on the eyeball; yet, if one bears in mind the optical effect of the glass cornea and the optical elimination of the natural cornea, it becomes apparent that an astigmatic effect can be dispensed with. It goes without saying that contact glasses allow the correction of visual acuity only in amblyopias due to

optical deficiencies; if the cause of the decrease in acuteness of vision is a lesion of the eyeground, this part of the loss of visual acuity is not improved. Hence, if there are severe lesions of the eyegrounds in high myopia, the power of the contact glasses to correct vision is correspondingly diminished.

From the haptic point of view, the practical utility of Mueller's contact glasses—so far as I can gather from my experiments—is safely established. The mechanical adaptation of the glass to the anterior segment of the eye takes place easily, and the good fit of the glass, provided it has been exactly adapted, is secured by its shape, as it resembles the ordinary prothesis. Several of my patients have been able to tolerate the glass easily all day without any trouble. Two patients (cases 21 and 9) have used their contact glasses steadily throughout the day for more than half a year. The second even sleeps with the glass. Both of them can take out their glasses and replace them with great ease. The glass is first inserted under the upper eyelid, and is first withdrawn from under the lower eyelid. I have inured my patients to the wearing of contact glasses by causing them to wear the proper glass selected for practical use for only half an hour the first day, for an hour the second day and then for one more hour each subsequent day until it was tolerated the entire day. One or two times a day the glass is taken out for a short time, cleansed and at once inserted again. On rare occasions the glass turns somewhat in the conjunctival sac, its lower portion, for instance, moving inward. The patient himself becomes aware of this immediately and brings the glass into the right position by means of his fingers. The glass was tolerated perfectly in a test period of three or four weeks in cases 1, 2, 3, 8, 10 and 16. On the contrary, although the optical effect of the glass was faultless in case 28 and visual acuity was strikingly improved, the patient could not wear the contact glass longer than half an hour. The functional condition of the patient's nervous system often plays a rôle. At the first trial I use a 2 per cent tutocain solution; later, however, no anesthetic. The use of cocaine is inadvisable because of its well known action on the epithelium of the cornea. On the insertion of the glass an air bubble sometimes forms behind the glass cornea; by the injection of a fluid behind the glass, this air bubble can be removed. It is not necessary to do this, because the air bubble is displaced after a short time when the full adhesion between the eye and the glass has set in. For the insertion and removal of the contact glass neither suction bulbs as suggested for this purpose nor hooklets are necessary. The patients perform this action easily with their own fingers. The adhesion between the glass and the eye is particularly favorable with Mueller's contact glasses because of the large scleral face and the prothesis-like shape of the

glasses. For this reason these glasses move simultaneously with the eyeball. This shape is of particular advantage in myopia, whereas the fact that the glass cornea of these contact shells has not quite a spherical shape cannot be considered as a serious drawback, since the form of myopic eyes is asymmetric in nearly every case.

The question as to whether Mueller's contact glasses can be tolerated for a certain length of time without injury to the eye can, according to my experience, be answered in the affirmative. Several pathologic changes due to the wearing of contact glasses have been reported in the literature. These were, however, in most cases transient phenomena which disappeared soon after the use of the glasses had been stopped for a while. Thus Clausen observed a severe infiltration in keratoconus after prolonged wearing of Mueller's contact shell, which healed up at the end of three or four weeks. Similar observations were made by Clausen with Zeiss' contact glasses in a case in which there was complete sloughing of the conjunctiva near the limbus; he also noted extensive corneal erosions. Hartinger designated the departure of the globe from the spherical form as the cause of such trouble. In high myopia such a departure is almost the rule; nevertheless, I have not seen one severe deformation of the eyeball in my patients with high myopia treated with Mueller's contact glasses. Wissmann had good experiences with Mueller's contact glasses in this respect, as the glasses were worn for from twelve to twenty-four hours without injury. Erggelet was able to tolerate these blown contact glasses on his eyes for hours without annoyance. I have, in general, seen no trouble in my patients. Serious ulceration of the cornea or sloughing of the conjunctiva did not occur, since the shell, resting on the conjunctival portion of the two canthi, exerts no pressure on the cornea and the adjacent conjunctiva. I have at times noted pressure marks at the superior and inferior rims of the glass. These pass away, however, when a proper procedure is employed. The firm of Mueller is advised of this circumstance at the time the trial lens is forwarded, and the glass for practical use is consequently submitted to the necessary correction on being blown. I have not observed compression of conjunctival vessels; in rare instances several thicker vessels pinched above, at the level of the superior rim of the glass, will occasion slight annoyance. Mueller's contact glasses are given such a shape that the upper diameter of the glass sclera is shorter; therefore when the patient looks up, this border of the glass does not touch the upper conjunctival fold, which is known to be very sensitive to contact with foreign bodies. Of course, lacrimation and glare, as well as slight conjunctival redness, occurred in most cases within the first hours the glass was being worn. All of these phenomena, however, disappeared soon. In one of my patients (case 9) small deep pits in the bulbar conjunctiva, near the limbus, associated with fairly

severe pericorneal injection, pain and photophobia, occurred as late as a week following the wearing of the glass. After its use had been interrupted for twenty-four hours, the glass could be worn without further trouble. Another patient (case 37) presented small, pearly epithelial vesicles on the cornea, with photophobia, pain and pericorneal injection. Two days after the patient had ceased to wear the glass the symptoms disappeared. On the other hand, the patient in case 21, who has used the glass for more than half a year, experiences headache and dizziness at once when he takes out the contact glasses during the day. Nor is the steady wearing of the contact glass, in spite of its fragility, a danger to the eye. Most authors agree that from this standpoint contact glasses offer even less risks than do common spectacles. I have never seen a contact glass break that fitted snugly to the eye. Heine [20] stated that contact glasses have broken when in place on the eyeball without injuring the eye.

As to the physiologic point of view, it can be said that the eye approaches the physiologic conditions much closer behind contact glasses than it does behind spectacles. The contact glass follows all the movements of the eye. Properly speaking, there is no optical correction by spectacles in lateral excursion movements of the eye, by which fact the field of vision and the field of fixation are the losers. By contact glasses, however, the field of vision and the field of fixation are not at all contracted. In my patients I have often had the opportunity to convince myself of this fact. The conservation of the full fields of vision and fixation by contact glasses plays an outstanding part from the occupational point of view of myopic persons. Another advantage in high myopia is the fact that the retinal image is more highly magnified by contact glasses than by common glasses. Several of my patients who could hardly accustom themselves to common glasses were deeply gratified by the great relief due to the lack of reduction of the objects by the contact glasses. Contact glasses are also free from the astigmatism caused by oblique pencils of light and the chromatic tilting differences peculiar to common glasses, which prove particularly annoying when strong concave lenses are used. Some authors have pointed out that with contact glasses in the long run a better balance of the extra-ocular muscles may be obtained than with common spectacles. The disappearance of muscular insufficiency and dynamic divergence in myopia has been observed (Heine). I have observed that if binocular vision proved to be normal during the objective test carried out prior to the correction by contact glasses, it always remained normal behind the contact glasses. I have never observed any trouble with binocular

20. Heine: Ueber den Ausgleich sämtlicher Brechungsfehler des Auges durch geschliffene Haftgläser, München. med. Wchnschr. **77**:6, 1930.

vision; on the contrary, I had two cases in which there had been monocular vision, and after correction with contact glasses regular binocular vision was ascertained objectively. This was true of the patient in case 11 with high myopia of one eye and slight myopia of the other. The contact glass on the highly myopic eye gave good correction. Worn on only one side, it restored binocular vision. The second patient (case 25) suffered, too, from anisometropia (right eye, — 1; left eye, — 8), with absence of binocular vision. The contact

Fig. 1.—Patient with divergent strabismus: *A*, without glasses; *B*, with common spectacles, and *C*, with contact glasses (disappearance of divergent strabismus).

glass on the left eye gave good correction. Binocular vision was restored by means of the contact glass. In case 17, the patient had bilateral myopia of — 8 diopters. By a — 8 diopter concave lens the visual acuity could be corrected to 5/5. He read the smallest Snellen types with a — 5 diopter lens at the common reading distance. However, he was not able to read for more than from ten to twenty minutes, because eyestrain and headache occurred. He presented a slight muscular insufficiency and, without spectacles, a slight myopic divergence. Although the contact shells corrected only up to 5/10. he read

the smallest Snellen types with them. After having worn the contact glasses for a week, he stated that with the contact glasses in position he was able to read and write for hours without any trouble. Diplopia due to the bilateral use of contact glasses occurred in only one case (case 37), but lasted for only four days.

The cosmetic effect of the contact glass is good if the glass is accurately selected. The luster of the glass cornea and the tint of the

Fig. 2.—Patient wearing contact glasses.

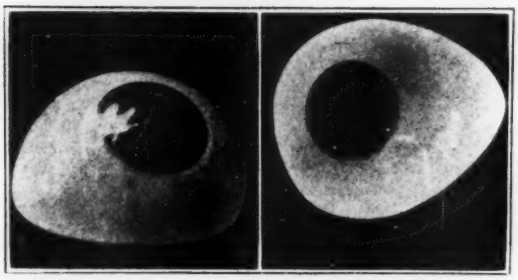

Fig. 3.—Contact glasses: left, anterior surface; right, posterior surface.

glass sclera, by perfectly simulating that of the natural sclera, produce a normal effect even at close range. Figure 1 shows the same person without glasses (*A*), with common spectacles (*B*) and with contact glasses (*C*).

The optical, physiologic and cosmetic effects of the contact glass concur in accomplishing a physiologic effect. By this I mean the self-confidence to which highly near-sighted males and females can be aroused by the wearing of contact glasses. Winking, wrinkling of the skin of the forehead and the distressing sensation of the visible, thick spectacles

are lacking; sports can be pursued, etc. Lindner [21] and Deutsch mentioned a nearsighted opera singer who moved on the stage easily with contact glasses, and a near-sighted professional woman swimmer who with contact glasses over her eyes saw the goal at a match very well. In this respect I had a similar experience with one of my patients whom I have mentioned. He was an engineer, now at the head of a public agronomic institute. I observed a change in his whole carriage; his timidity, self-effacement, anxious study of known features and continual wiping of his spectacles vanished with the wearing of contact glasses which corrected his astigmatic high myopia, only poorly corrected by spectacles.

It is necessary to consider contact glasses from one other standpoint, the theoretical, especially as many have expressed the opinion that contact glasses have not only an optical influence but a healing effect on the eye itself. Thus Clausen feels that contact glasses can also exert a healing effect on a conical cornea by conferring a certain degree of resistance on the apex of the cone, thus stopping the process. Stock reported the case of a man who himself had the impression that his conical cornea was favorably influenced by the wearing of a contact glass. Scheffels expressed the opinion that the wearing of a contact glass in keratoconus possibly exerts a favorable influence on the pathologic process itself. Von Hippel observed a decrease in corneal opacities after Mueller's contact glass had been worn for one year. Dohme has observed that a corneal opacity somewhat cleared up under the pressure of a Zeiss contact glass. Heine was able to decrease the high pressure in glaucoma by the wearing of a contact glass. In myopia, too, Heine observed that after the wearing of contact glasses the degree of myopia was lowered and the astigmatism lessened. Heine claimed that in astigmatism the cornea probably approaches the normal form in the long run, owing to the pressure and aspiration exercised by the spherical shell. Further, he assumed that the permanence of the mild pressure of the contact glass is sufficient to allow the shape of the eye—especially in youth—to change and myopia thus to decrease. Heine felt, therefore, that children with low myopia ought to be treated by means of contact glasses in order to prevent the condition from progressing and, if possible, to achieve regression in the degree of myopia.

In spite of the fact that I have dealt with the therapeutic effect of the contact glasses, I wish to emphasize that I did not mean to present my experiences, because the follow-up observation of my patients affected with high myopia has been too short to allow me to pronounce on this matter. The further observation of my patients who are wearing Mueller's contact glasses will, no doubt, yield valuable evidence as to the therapeutic effect of the contact glass.

21. Lindner: Ueber das Einlegen von Kontaktgläsern, Klin. Monatsbl. f. Augenh. **82**:534, 1929.

ORBITAL METASTASES FROM MALIGNANT TUMORS OF THE SUPRARENAL GLAND*

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Metastatic tumor of the orbit is sufficiently uncommon to warrant the report of a case. Primary orbital sarcomas occur with such relative frequency that one may readily overlook the possibility of any orbital tumor being secondary to a primary growth elsewhere. Obviously, the great majority of orbital malignant growths are primary and are of mesoblastic origin, but Morax [1] collected six cases of metastatic sarcomas of the orbit. Bride [2] also reported one, metastasized from cancer of the thigh, bringing the total to seven. One of Morax's series (Bietti) probably had its origin from a tumor of the right suprarenal gland. Unless an autopsy is done the primary growth may never be discovered, in the absence of history of a previous malignant growth or of evidence of cancer elsewhere in the body, as illustrated by my case.

Among the 1,566 instances of orbital tumor collected by Birch-Hirschfeld,[3] 693 were benign, 710 were sarcomas and 264 were malignant tumors of epithelial origin. Most of the last group were secondary extensions either from the contiguous sinuses or brain, or from the eyelids, conjunctiva, lacrimal gland or sac. It is conceivable that primary orbital carcinomas may occur, as in the 3 cases reported by Knapp,[4] van der Hoeve [5] and Happe.[6] In the case reported by Knapp, he suggested that the growth may have originated from rest cells that had become isolated during the embryonic development of the lacrimal gland. In van der Hoeve's case of encapsulated basal cell carcinoma, he assumed "an aberrant epithelial cell as the cause." Happe accepted a

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1. Morax, V.: Cancer de l'appareil visuel, Paris, Gaston Doin, 1926, p. 416.

2. Bride, T. M.: Case Report: Neoplasm of Orbit (Secondary), Tr. Ophth. Soc. U. Kingdom **49**:462, 1929.

3. Birch-Hirschfeld: Krankheiten der Orbita, in Graefe-Saemisch: Handbuch der gesamten Augenheilkunde, Leipzig, Wilhelm Engelmann, vol. 17, pt. 2, chap. 135, p. 715.

4. Knapp, Arnold: Report of Carcinoma of the Orbit, Arch. Ophth. **48**:120 (March) 1919.

5. van der Hoeve, J.: Carcinoma Orbitae, Klin. Monatsbl. f. Augenh. **74**:6 (Jan.) 1925.

6. Happe, Helmuth: Primäres retrobulbäres Karzinom der Orbita, Axenfeld's Festschrift, Klin. Monatsbl. f. Augenh. **78**:93 (June) 1927.

similar explanation for his case. Friedenwald [7] has suggested that a primary growth may originate also from the ciliary ganglion. In 1921, Finnoff [8] reviewed 17 cases of metastatic carcinoma of the orbit to which there may be added 8 others; viz., those of Knapp,[9] Guego,[10] van Duyse and Marbaix,[11] Hird,[12] Agatston,[13] Ginsberg,[14] Rollet and Colrat [15] and Ford.[16] In Ford's case the growth may have been an extension from the brain, as there was no autopsy. Thus it is evident that nearly all metastatic carcinomas involving the orbit, of which only 25 are reported in the literature, have had their origin from some remote primary focus, usually the breast.

In contrast to this group of 25 orbital carcinomas, one finds about 125 intra-ocular carcinomas of metastatic origin collected by Marshall,[17] Suker and Grosvenor,[18] Usher,[19] Greenwood [20] and Clapp,[21] with additional cases by Knapp,[22] Cohen and MacNeal,[23] Kiep,[24] Thomas and

7. Friedenwald, J. S.: Pathology of the Eye, New York, The Macmillan Company, 1929, p. 314.

8. Finnoff, W. C.: Carcinoma of the Orbit, Am. J. Ophth. **4**:251 (April) 1921.

9. Knapp, Arnold: Metastatic Thyroid Tumor of the Orbit, Arch. Ophth. **52**:68 (Jan.) 1923.

10. Guego, in Morax (footnote 1, p. 412).

11. van Duyse and Marbaix: Métastase ethmoido-orbitaire d'un hypernéphrome latent, Arch. d'opht. **39**:396 (July) 1922.

12. Hird, R. B.: Hypernephroma of the Orbit, Tr. Ophth. Soc. U. Kingdom **41**:457, 1921.

13. Agatston, S. A.: Metastatic Carcinoma of the Orbit: Case Report, Arch. Ophth. **54**:313 (March) 1925.

14. Ginsberg, S.: Doppelseitige Sehnervenmetastasen eines Bronchialkarzinoma als Ursache völliger Erblindung, Klin. Monatsbl. f. Augenh. **67**:232 (April) 1921.

15. Rollet and Colrat: Les métastases orbitaires des tumeurs de la surrénale, Arch. d'opht. **41**:583 (Oct.) 1924.

16. Ford, R.: Orbital Tumour Secondary to Spheroidal Celled Carcinoma of Breast, Proc. Roy. Soc. Med. **21**:108 (Oct.) 1927.

17. Marshall, C. P.: Metastatic Carcinoma of the Eye Ball, Roy. London Ophth. Hosp. Rep. **14**:415 (Dec.) 1897.

18. Suker, G. F., and Grosvenor, L. N.: Metastatic Carcinoma of the Choroid, Tr. Am. Acad. Ophth., 1908, p. 148.

19. Usher, C. H.: Case of Metastatic Carcinoma of the Choroid and Iris, Brit. J. Ophth. **7**:10 (Jan.) 1923.

20. Greenwood, A.: Carcinoma of the Choroid, Tr. Internat. Cong. Ophth., 1922, p. 567.

21. Clapp, C. A.: Metastatic Carcinoma of the Choroid, Am. J. Ophth. **9**:513 (July) 1926.

22. Knapp, Arnold: Case of Metastatic Carcinoma of the Eye Ball, Arch. Ophth. **54**:389 (Feb.) 1925.

23. Cohen, M., and MacNeal, W. J.: Metastasis of Carcinoma into an Endothelioma of the Optic Sheath, Arch. Ophth. **50**:128 (March) 1921.

24. Kiep, W. H.: Carcinoma of the Choroid, Tr. Ophth. Soc. U. Kingdom, 1928, p. 428.

Sladdon,[25] Pollakova,[26] Cordes and Horner [27] and McDannald and Payne.[28] Greater frequency of involvement of the globe than of the orbit is explained by the retarded circulation and special vascular susceptibility of the uveal tract through the ciliary vessels. The peculiar frequent invasion of the extra-ocular muscles in orbital metastases has likewise been explained by lodgment of cancer emboli in the arterioles of the muscles, which, like the ciliary vessels, also originate from the carotid. Shumway [29] believed that this invasion of the extra-ocular muscles by metastatic orbital growths is so frequently observed that it should always arouse suspicion of a primary growth elsewhere.

Tumors of the suprarenal gland are of two distinct types, one originating in the medullary portion and the other in the cortex of the gland. Both types metastasize readily and may give rise to orbital or intraocular metastases and therefore are of especial interest to the ophthalmologist. Both suprarenal glands are frequently involved. Rolleston's [30] explanation for simultaneous tumors in both suprarenal glands is that growth spreads by continuity from one to the other. He also explained the occasional involvement of the liver with the right suprarenal gland by direct continuity and because their free surfaces are uncovered by peritoneum. Apparently there is little association of these tumors with Addison's disease. With the suprarenal group are associated the tumors originating in the suprarenal rests in the kidney, the true hypernephroma or malignant nephroma. These are fairly frequent in occurrence and usually present a destructive clinical syndrome. They have been and are being confused with the true suprarenal tumors as regards terminology because of the name "hypernephroma," which implies a suprarenal tumor. Pathologists are not agreed as to their histogenesis, and no definite differential histologic criteria have permitted their separation as an entirely separate group. While in general their classification is not always difficult histologically, a few have been found to baffle the best of clinicians and pathologists until necropsy. Adami [31] preferred the term "mesotheliomas" for the group involving the suprarenal cortex.

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25. Thomas, R., and Sladdon, A. F.: A Case of Metastatic Carcinoma of the Choroid, Lancet **1**:544 (March 12) 1927.

26. Pollakova, J.: Metastatic Carcinoma of the Choroid, abstr., Am. J. Ophth. **13**:267 (March) 1930.

27. Cordes, F. C., and Horner, W. D.: Metastatic Melanoma of Both Eyes, J. A. M. A. **95**:655 (Aug. 30) 1930.

28. McDannald, C. E., and Payne, B. F.: A Preliminary Report of a Case of Metastatic Carcinoma of the Choroid and Optic Nerve, Arch. Ophth. **4**:289 (Aug.) 1930.

29. Shumway, E. A.: Metastatic Carcinoma of the Orbit, Tr. Am. Ophth. Soc. **12**:161, 1909.

30. Rolleston, H. D.: Primary Malignant Disease of the Suprarenal Bodies, Am. J. M. Sc. **116**:383 (Sept.) 1898.

31. Adami, J. G.: Tr. A. Am. Physicians **17**:627, 1902.

Hypernephromas or malignant nephromas of the clear cell type originating in the kidney and constituting the majority of the suprarenal rest tumors are known to metastasize most frequently in the lungs and bones; orbital or intra-ocular metastasis from this type has also been reported. Diagnosis of a metastatic growth anywhere from "malignant hypernephroma" offers little difficulty. It is possible to diagnose the type from the orbital or intra-ocular metastasis, although highly malignant mesoblastic suprarenal tumors of the kidney, sometimes known as adenosarcoma if found metastasized in the orbit, may offer considerable difficulty in diagnosis.

The tumors that arise from the medullary portion of the suprarenal gland are in a class by themselves. Wright [32] suggested the term neuroblastoma or neurocytoma to indicate the type of malignant growth that may originate wherever sympathetic nerve tissue is represented. The term sympathicoblastoma is also applied to them because they are histologically similar to embryonic sympathetic nerve tissue. These tumors bear a marked resemblance to retinoblastomas in that both have rosette formations. No one has been able absolutely to establish the origin of the cells of retinoblastomas, and it remains to be demonstrated whether there is a distinct relationship between them and the neuroblastomas.

In a report of seven cases, Hutchinson [33] first called attention to the definite eye syndrome in connection with this group. The first clinical signs observed in the majority of cases are growths involving the cranial bones and the cervical glands, with orbital hemorrhage, proptosis and ecchymosis of the lids, often associated with optic neuritis and blindness. Secondary anemia, cachexia and exhaustion are marked, and practically all the patients have died within six months. The ocular and other metastatic evidence often is noted before the abdominal tumor is discovered. Seefelder [34] is of the opinion that the presence of exophthalmos associated with ecchymosis in the lids in children makes it quite uniformly possible to diagnose the origin of the orbital growth. Examination will reveal an abdominal tumor as the primary site of cancer in most children, and therefore any operative treatment for the orbital condition is distinctly contraindicated.

In the series of fifty-one medullary suprarenal tumors collected by Frew,[35] the age range was from 2 weeks to 10 years, with the greatest incidence in the second and third years. This corresponds to the age

32. Wright, J. H.: Neuroblastoma, a Kind of Tumor not Generally Recognized, J. Exper. Med. **12**:556 (July) 1910.

33. Hutchinson, R.: Suprarenal Sarcoma in Children with Metastases in the Skull, Quart. J. Med. **1**:33 (Jan.) 1907.

34. Seefelder, R.: Orbitale Metastase eines Neuroblastoma sympathicum, Arch. f. Augenh. **92**:7 (Dec.) 1922.

35. Frew, R. S.: On Carcinoma Originating in the Suprarenal Medulla in Children, Quart. J. Med. **4**:123 (Feb.) 1910.

incidence for retinoblastoma. Most of the cases reported by Frew showed cranial metastases; fourteen showed exophthalmos. When the right suprarenal gland was involved, the orbital metastases were always in the right orbit first. Carter [36] supported Frew's thesis that the metastases occur through the lymphatic stream because "on the left side the lymphatics pass out of the suprarenal gland with the suprarenal vein, join the lymphatics of the left renal vein and connect with the lumbar nodes and aortic lymphatics. Some of them pass downward into the groin; others pass upward forming a chain of glands around the aorta to the deep anterior cervical chain and thence into the skull. The lymphatics of the right suprarenal gland run into the thoracic duct directly without communication with the lumbar glands." Thus, he believed, the distribution of metastases indicated that the dissemination of growth occurs either forward with the lymph stream or in a retrogressive fashion through the lymphatic channels, and not by way of the blood stream.

Diagnosis of the neuroblastomas involving the orbit in children can be confused only with chloroma, scurvy and trauma. Chloroma is more frequently bilateral and may be excluded by the blood picture, but a history of trauma preceding the occurrence of the orbital ecchymosis is exceedingly common in the suprarenal neuroblastomas.

Cases of neuroblastoma, in addition to those in the bibliography of Frew and others, have been reported by Herxheimer,[37] Wessely,[38] Tileston and Wolbach,[39] Quackenboss and Verhoeff,[40] Seefelder,[34] Hill (and Greenwood),[41] Coppez, Simon and Cloes,[42] Barnard,[43] Platt,[44] Bendixon and Lamb,[45] and Wollstein.[46]

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36. Carter, W. E.: Medullary Malignancies of the Suprarenal Gland with Report of Cases, Am. J. Dis. Child. **22**:244 (Sept.) 1921.

37. Herxheimer, G.: Ueber Tumoren des Nebennierenmarkes, insbesondere das Neuroblastoma sympathicum, Beitr. z. path. Anat. u. z. allg. Path. **57**:112, 1913.

38. Wessely, K.: Ein bisher noch nicht beschriebener Fall von Orbitaltumor, Arch. f. Augenh. **85**:57, 1919.

39. Tileston, W., and Wolbach, S. B.: Primary Tumors of the Adrenal Gland in Children, Am. J. M. Sc. **135**:871 (June) 1908.

40. Quackenboss, A., and Verhoeff, F. J.: Tumor of the Adrenal Gland with Metastasis in the Orbit, Tr. Am. Ophth. Soc. **12**:451, 1910.

41. Hill, H. F.: Metastatic Orbital Tumor, Am. J. Ophth. **12**:412 (May) 1929.

42. Coppez, H.; Simon, S., and Cloes, E.: Un cas de sympathicoblastome métastatique de l'orbite, Arch. d'opht. **44**:193 (April) 1927.

43. Barnard, H. L.: A Case of Sarcoma of the Left Suprarenal Body with Secondary Deposits in the Cranial Bones, Tr. Clin. Soc., London **37**:216, 1903-1904.

44. Platt, A. H.: Sarcoma of the Suprarenal Gland with Invasion of the Orbit, Ophthalmoscope **9**:107, 1911.

45. Bendixon, P. A., and Lamb, F. H.: Malignant Tumors of the Adrenal in Children, J. Lab. & Clin. Med. **12**:130 (Nov.) 1926.

46. Wollstein, M.: Neuroblastoma of the Adrenal in Young Children, Surg., Gynec. & Obst. **46**:774 (June) 1928.

Tumors of the suprarenal cortex occur mostly in adults and present an entirely different clinical picture. They cannot be clearly differentiated from hypernephromas. Some of them are classified as sarcomas, while others show distinctly adenomatous or carcinomatous histologic structure. The most characteristic microscopic picture shows the cells irregularly polygonal in outline and the protoplasm slightly granular and strongly basophilic. Karyokinesis is usually evident, many mitotic forms being present. There is a dense irregular stroma infiltrated with lymphocytes and containing many blood-filled capillaries. Clusters of large epithelial cells with large centrally located nuclei may be seen among the normal cells.

The cortical tumors may also give rise to either intra-ocular or orbital metastases. Four instances of uveal metastases, in which primary growth originated from "malignant nephromas," have been reported by Bentzen,[47] Chance,[48] Schlipp[49] and Stock.[50] In Bentzen's patient, aged 30, the carcinoma of the right suprarenal gland was, like the other three, discovered only at autopsy.

Chance's case of secondary hypernephroma of the left iris and ciliary body was in a man of 40, with a history of trauma. The first diagnosis lay between sarcoma and syphilis. The pathologic diagnosis of the tumor of the iris removed was perithelial sarcoma. The patient died seven months later. What was supposed to have been a primary growth proved secondary to hypernephroma from suprarenal rests in the left kidney. Chance was convinced in the somewhat similar occurrence published by Schlipp that the ocular tumor originated from a hypernephroma. Stock's patient had double uveal metastases, diagnosed as cyclitis with detachment. The true nature of the ocular growths was not recognized because scleral transillumination of both eyes was perfect. At autopsy both eyes showed the choroids and the ciliary bodies entirely infiltrated with tumor tissue similar to a hypernephroma found in the right kidney. Metastases in the brain and the thyroid were also present.

Three or possibly four instances of orbital metastases from the suprarenal gland have been found similar to my own case described here. Rollet and Colrat's[15] patient, aged 65, developed a cervical adenitis the biopsy of which showed an epithelioma, which responded to radium therapy. When first seen by Rollet, four months later, a

47. Bentzen, C. F.: Om metastatisk oftalmi, Hospitalstid. **8**:765 (July) 1900.

48. Chance, B. K.: A Case of Secondary Hypernephroma of the Iris and Ciliary Body, Tr. Am. Ophth. Soc. **11**:178, 1906.

49. Schlipp, R.: Ueber einen epithelialen Tumor des Ciliarkörpers, Arch. f. Ophth. **48**:353 (June) 1899.

50. Stock, W.: Ein doppelseitiges metastatisches Hypernephrom der Uvea, Axenfeld's Festschrift, Klin. Monatsbl. f. Augenh. **78**:116, 1927.

right recurrent paralysis had developed, followed quite rapidly by unilateral exophthalmos. Examination revealed a tumor of the superior external angle of the orbit. The patient died a month later, and at autopsy a double carcinoma of the suprarenal glands was found, with metastases also present in the right cervical glands, lungs, liver, brain and other organs. The growth had penetrated the roof of the right orbit and frontal sinus. Histologic examination showed the same characteristics in the orbital and the suprarenal cortex tumors. The authors commented on the fact that the microscopic characteristics are histologically similar in the orbital growths originating in the suprarenal medulla; this may not always be true of orbital metastases originating in the cortex if the primary growth in the cortex is atypical or a sarcoma; therefore, microscopic diagnosis of an orbital growth originating in the suprarenal cortex may not be made with absolute certainty.

In Hird's [12] patient, aged 41, there was a definite proptosis together with retinal detachment and a large yellowish and vascular mass projecting into the vitreous. There was partial paralysis of the third nerve. At autopsy the left eye showed a growth "surrounding the globe posteriorly and extending into the vitreous through the choroid with detachment of the retina. This was examined microscopically and diagnosed as hypernephroma before hearing the result of the general condition found post mortem. This showed hypernephroma with secondary deposits in the lungs and heart. The section of the globe shows the typical structure of such tumors."

In the case of van Duyse and Marbaix,[11] cancer of the suprarenal occurred in a man, aged 67. The suprarenal tumor had not caused symptoms. The patient first came under observation because of epistaxis of the right nostril and exophthalmos of the left eye with displacement down and outward. There was complicating frontal and maxillary sinusitis. A diagnosis of choroidal tumor was made. The sinus was curetted and revealed a penetration from the orbit. Histologic examination of the orbitosinus tumor showed that it was a metastatic neoplasm of the suprarenal type. Whether it first metastasized in the sinus or in the orbit is not clear. Following microscopic diagnosis of the orbital growth, existence of the left suprarenal tumor was proved by means of roentgen and physical examination.

In Bietti's [51] patient, aged 65, the symptoms began with backache, persisting three years. Exophthalmos appeared in the left eye, with limitation of ocular movements from the involvement of the inferior rectus. Subcutaneous tumors developed just preceding death. Autopsy showed a retroperitoneal tumor, which was believed to have its origin in the right suprarenal gland because it was principally involved,

51. Bietti, A.: Metastatisches endotheliales Sarkom im Musculus Rectus Inferior, Klin. Monatsbl. f. Augenh. **54**:462, 1915.

although its possible origin in the lymphatics could not with certainty be excluded. Other metastases were generally distributed in the viscera, mediastinal lymphatics and elsewhere. The tumor was described as having an alveolar structure with giant cells.

In my own case, the true character of the orbital growth was also revealed at autopsy.

REPORT OF A CASE

A. R., aged 33, a lithographer, on Aug. 3, 1925, sought aid for a small subconjunctival hemorrhage of the right eye and a slight visual impairment noticed only four days previously.

The patient was a large, robust man of 225 pounds (102 Kg.), the picture of health, with no history of illness since childhood excepting hay fever each autumn. For one week before reporting he had a feeling of evening fever, night sweats and anorexia and, for two days, occasional nausea. His family history was without significance.

The left eye was found normal in all respects, but examination of the right eye showed a very slight subconjunctival hemorrhage, and vision was 20/40. There was very slightly restricted ocular excursion. Diplopia was elicited only on extreme temporal upward and downward rotation. The media were clear. Moderate optic neuritis was noted in the right eye, with not over 1 diopter of elevation of the nerve head. The veins were overfilled, but the arteries were of normal size. The field of vision in this eye was constricted on the nasal side and entirely lost temporalward. Very slight proptosis was evident without any lateral displacement. Pressure on the eyeball was only slightly resistant; bruit was not present, and no tumor could be felt. There was no enlargement of the preauricular or submaxillary glands.

Physical examination revealed a pulse rate of 108, temperature increased to 100 F., and albuminuria with a few pus cells. The blood picture was normal; the differential count was normal; a leukocytosis of 11,350 was present; the Wassermann reaction was negative. Roentgenograms of the sinuses and sella showed no abnormalities. The general physical examination later by Drs. George Senkler and Ernest Richards was entirely negative. Examination of the nose and throat by Dr. George Walker showed chronic tonsillitis, pyorrhea and a slight postnasal discharge without obstruction of the passageways. There was no evidence of sinus involvement. The patient had had a cold for three or four weeks. There were no symptoms of increased intracranial pressure.

Four days later, the patient again reported and complained of diplopia and discomfort on extreme rotation of the globe in any direction. Vision in the right eye had diminished to 10/200, and there was increased prominence of the right eyeball. The leukocyte count was 11,400.

When the patient reported five days later, he complained of anorexia, night sweats, insomnia and increased weakness without change in the orbital picture. Six days later a definite increase in the optic neuritis was noted. The exophthalmometer now measured 5 mm. of proptosis in the right eye. Since his last visit he had vomited daily, felt increasingly weaker and lost 8 pounds (3.6 Kg.), and pain and tenderness had developed in and around the right eye. There was slightly more nasal discharge. On my insistence, the right ethmoid and sphenoid were explored by Dr. Walker, but nothing was found. The patient was admitted to the Miller Hospital in St. Paul for further study and for a spinal puncture. The spinal fluid was not under pressure, and its examination proved negative. A definite orbital tumor was diagnosed, and orbital exploration was considered, but was not

done pending further study and observation for a possible intracranial growth. On August 22, there was a mild convulsive attack without loss of consciousness, with twitching of the right facial nerve. The pulse was very rapid and small; the tongue deviated to the right on protrusion. These facial convulsive attacks, lasting two or three minutes, recurred very frequently during the next few days. Comprehension was clear, although articulate speech was difficult. The right optic nerve showed an increase of papillitis. The left eye and orbit remained normal, and vision was 20/20. The patient grew rapidly worse; the pulse rate stayed around 100; there was profuse sweating. He complained of a slight numbness of the right side of the body, and on September 5, a peculiar subcutaneous mottling developed over his back and hips. He now grew rapidly worse, and vomiting persisted. He continued to show only moderate albuminuria; the blood on chemical examination was entirely normal. Leukocytosis of from 20,000 to 21,000 persisted, with a differential count of 39 lymphocytes and 61 polymorphonuclears, which was

Fig. 1.—Exophthalmos with 5 mm. of proptosis.

about the ratio until the end. A daily elevation of temperature to 100 F. continued; the pulse varied from 100 to 130 and was of poor quality. Exophthalmos now increased quite noticeably; the conjunctiva was chemotic (fig. 1). The monocular papillitis at this stage became a papilledema with 2 diopters of elevation of the nerve head and many retinal hemorrhages bordering the nerve margin. The neurologic examination by Dr. E. M. Hammes gave negative results. The patient grew rapidly worse, lapsed into unconsciousness and died, September 11, about five weeks after his first consultation for an apparently insignificant subconjunctival hemorrhage.

I had arrived at no diagnosis other than exophthalmos with optic neuritis—definitely an orbital tumor. Exploration of the orbit was not done because of the patient's alarming physical weakness from some inexplicable cause, which the autopsy by Dr. Margaret Warwick revealed. An abstract of Dr. Warwick's autopsy notes, together with subsequent microscopic study, has been furnished through the courtesy of Dr. Kano Ikeda, pathologist to the Miller Hospital.

Report of Autopsy.—The body was that of a well developed, obese man with a length of 180 cm. The body was still warm, and no rigor, lividity, edema, cyanosis or jaundice was present. There was a small linear scar over the right inguinal region, and there was a very marked exophthalmos of the right eye. The right lids would not close, and an inflammation of the conjunctiva was obvious. Over the entire body was a thick layer of fat.

The right eye protruded to a moderate degree. When the roof of the orbit was opened, the fat protruded as if under pressure. On removal of this, a tumor was found around the optic nerve, fairly smooth in outline but somewhat rounded and nodular and measuring 3 by 2.5 by 1.5 cm., apparently covered with a thin, membranous capsule (fig. 2). This tumor consisted of pale red, soft tissue which was uniform throughout. The tumor had a smooth surface, and although it entirely surrounded the optic nerve and appeared to be tightly wrapped around it, thus causing great pressure, it was easily separated from the nerve sheath. The tissue of this appeared to be identical with that of the suprarenal glands. When

Fig. 2.—Metastatic tumor of the orbit completely filling the muscle cone.

the eyeball was opened, no tumor tissue was visible or appeared to project into the chamber. The vitreous was clear.

The peritoneal cavity contained no excess fluid and showed firm, fibrous adhesions between the cecum and the anterior abdominal wall, evidently the sequela of a former hernial operation.

The left pleural cavity did not show any fluid or adhesions. The right pleural cavity was interrupted by firm fibrous adhesions over the lateral surface.

The right lung weighed 570 Gm., and the left lung weighed 690 Gm. Both showed over the external surfaces a prominent veining of black. Both were grayish and dry and fluffy in consistency. Gross sections showed a gray, dry surface, and on pressure a small amount of bloody fluid exuded. No pus could be demonstrated at any point. No tumors were found.

The liver weighed 2,260 Gm. It was dark red and uniform in color and consistency on gross section except at the lower margin where the liver came in contact with the right suprarenal gland, where there was a large tumor measuring about 5 cm. in diameter. This consisted of whitish tissue in which were numerous

red mottlings; the tumor faded almost imperceptibly into the normal liver tissue without any definite line of demarcation. It was of the same consistency as the liver tissue, and neither rose up above or contracted below the liver tissue on gross section. No other tumors were found. The gallbladder was normal in shape and size and showed nothing of interest on gross examination.

The right suprarenal gland with the kidney weighed 250 Gm., and the left suprarenal gland weighed 300 Gm. with the kidney on that side (fig. 3). Both suprarenal glands were enlarged to a very marked degree, dark red, very soft in consistency and also very friable, tearing on the slightest manipulation. The shape was that of the small suprarenal gland enlarged to a very marked degree, and they

Fig. 3.—Double carcinoma of the suprarenal gland.

fitted over the upper pole of the kidney in the same way as does the normal suprarenal gland. The left was much larger than the right, but of the same consistency and color. Gross section of both suprarenal growths showed the tumors to consist of pale, red tissue with a peculiar, striated arrangement and an outer congested zone that somewhat simulated the cortex of the kidney but was really the same tissue as the rest of the mass. Except for this outer congested zone, the tumor was uniform throughout. It lay close to the kidney on each side and overlapped it with a caplike effect, but it did not invade the kidney and was not connected with it in any way.

The capsules of the kidneys stripped readily, leaving smooth and shining surfaces. Gross section showed the cortex to be of the usual thickness and the markings distinct. The pelves and ureters appeared entirely normal.

Enlarged lymph nodes were found at the bifurcation of the trachea along the bronchial tree and along the aorta. All of these were of pale reddish-gray tissue, very soft in consistency, and suggested the same type found in the suprarenal glands and the orbital tumor.

All the other organs showed no changes bearing on the present discussion.

The diagnosis was: (1) carcinoma of the suprarenal glands (bilteral), (2) metastatic carcinomas in the liver, orbit and lymph nodes and (3) healed pleuritis (right).

Microscopic Study.—The primary tumor was enveloped by the original fibrous capsule of the suprarenal gland. The capillary lumina within the capsule were dilated and contained a few large tumor cells. Tumor cells also invaded the extracapsular fat. Immediately beneath the capsule were seen columns of large cortical cells (zona glomerulosa) singly and in bundles, running for a short distance into the substance of the mass. Between these columns of pale staining cortical cells

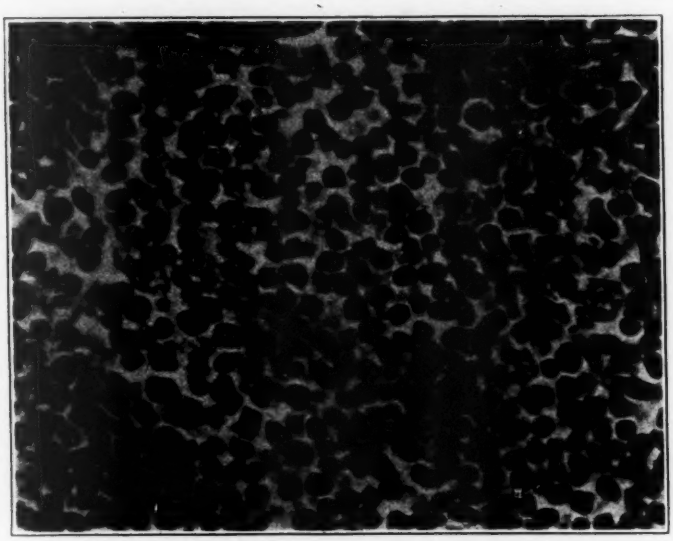

Fig. 4.—Section of the orbital tumor.

were nests and cords of tumor cells in the meshed network of reticular fibers and narrow capillaries, retaining a distinct alveolar arrangement to the structure. Deeper in the substance of the growth, the normal suprarenal structure was entirely obliterated by tumor cells. The alveolar network of the capillary endothelium was retained more or less prominently throughout the tumor, and here and there were seen what were undoubtedly dilated spaces of these capillaries filled with blood and a few tumor cells. In some areas there was a distinct overgrowth of the connective tissue stroma, which accentuated the alveolar appearance of the growth. Areas of necrosis and extravasation were also encountered, especially in the deeper portions. The tumor was, on the whole, very vascular. The tumor cells were relatively and uniformly large, round or polygonal, and showed a rather indistinct zone of cytoplasm (fig. 5). When the cell outline was distinct, the cytoplasm was homogeneous and somewhat basophilic, although the majority of cells showed the cytoplasm to be granular, foamy and apparently vacuolated with the cell outline ill defined. Minute fat granules could be demonstrated in the cytoplasm. The cells were represented by the large, round, oval or polygonal nuclei, quite vesicular

with deeply staining, condensed chromatin granules. A few of the cells showed a distinct nuclear lobulation; occasionally they were multinucleated, but these were not numerous. Numerous mitotic figures were present. No pigmented cells were identified. Transition forms from the cortical cells into undifferentiated tumor cells described by Woolley and Adami could be recognized along the periphery of the tumor.

The cells of the metastatic orbital tumor showed the morphologic characteristics of those found in the primary growth in every essential detail. The alveolar arrangement, however, was conspicuously absent. The cells were more solidly packed (fig. 4). There were areas of extravasation and necrosis. Many nuclear fragments and pyknotic cells were noted in these areas. Patches of fibrosis were also scattered in various parts of the section, some an evident extension of the thin capsule. In these fibrous patches and adjacent areas were scattered a number of golden brown pigment granules. The tumor cells infiltrated the sheath of the

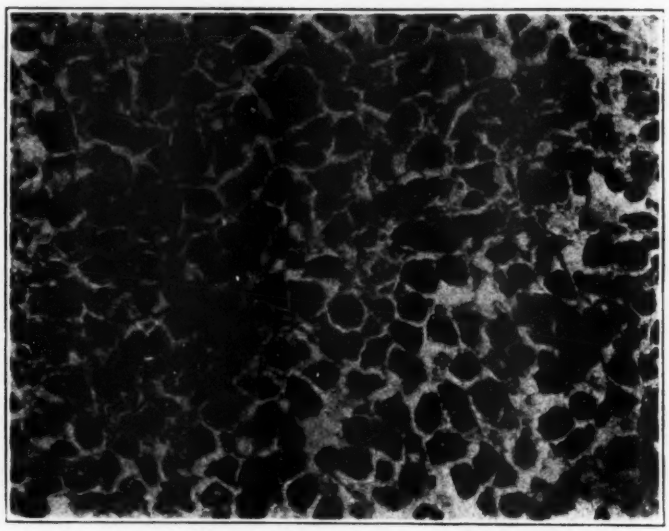

Fig. 5.—Section of the suprarenal tumor.

optic nerve. A few clumps of such cells were located in the lumina of the capillaries within the sheath. There was no infiltration of tumor cells into the nerve trunk. The choroid adjoining the disk was edematous and congested, and many tumor cells were found within its layers and, particularly, within the dilated capillaries. At one point, a wide column of the tumor cells partly penetrated the sclera, indicating probable extension of the tumor along a ciliary vessel. There were several small clumps of tumor cells in the choroidal layer.

Of particular interest was the mode of metastasis and dissemination of tumor cells in the lungs, which had been found essentially normal on gross examination. There was a diffuse dissemination of the tumor cells throughout the pulmonary parenchyma. First, there was a uniform widening of the alveolar loops due to the infiltration of the tumor cells along the capillary walls. The smaller vessels showed apparently a wide zone of perivascular accumulation of tumor cells. Many others showed a massive subendothelial collection of these cells. The larger vessels showed proliferation of tumor cells along the endothelium with formation of definite embolic masses of tumor cells projecting into the lumen. It is likely that these perivascular

and intravascular collections of tumor cells are brought about primarily by the same type of embolic process. An embolic tumor, thus limited by a new endothelial covering, may present the appearance of a subendothelial or even a perivascular infiltration of the tumor cells.

A few tumor cells were widely scattered in the interstitial tissue of the cortex of the kidney.

The tissue of the large mass of the liver consisted of the same type of cells as the primary tumor and showed within it islets of the liver parenchyma, presenting a compression, atrophy, fatty infiltration and necrosis of the cells with widening and congestion of the sinusoids. A few golden brown pigments were scattered in various parts of the section. Along the periphery of the growth might be seen periportal accumulations of tumor cells.

Involved areas of the lymph nodes showed the histologic pictures to be identical with those seen in other metastases.

The tumor originated in the cortical epithelium of the suprarenal gland. It might be designated as Adami's mesothelioma. That its behavior was sarcomatous as well as carcinomatous was clearly evident by the intravascular accumulations of the tumor cells that were universally found. This was most convincingly demonstrated in the lungs.

It would be of clinical and pathologic interest to speculate as to what the pathologic diagnosis of the orbital tumor might have been, had its removal been accomplished before the death of the patient. It is doubtful whether the localization of the primary lesion could have been made with any degree of certainty.

Problems in diagnosis of orbital tumors are usually not complicated. The development of monocular exophthalmos requires a differential diagnosis between a new growth and a growth of inflammatory origin. When the latter is excluded, one must consider the probable nature of the tumor and its origin. Especially before considering its removal must one further consider whether or not it may possibly be a metastasis from a remote primary growth elsewhere in the body. Metastatic sarcomas and carcinomas of the orbit are occasionally encountered. This is illustrated by the case herein reported. The case was unusual also in that there were no complaint of visual impairment and no evidence of exophthalmos until five weeks before death. The importance of a careful and complete clinical history and a thorough physical examination to exclude the possibility of both primary and secondary growths elsewhere is emphasized as a means of avoiding useless orbital surgical intervention. Even so, an autopsy may be the sole means of revealing the true character of orbital (or intra-ocular) neoplasms.

That a suprarenal tumor or hypernephroma may be the site of the primary growth is illustrated in 4 and possibly 5 of the 33 adult cases of orbital metastases collected from the literature; also in at least 4 of the 125 intra-orbital metastatic tumors reported. In infants and young children, involvement of the orbit by tumors originating in the suprarenal medulla is by no means infrequent.

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ABSTRACT OF DISCUSSION

Dr. Peter C. Kronfeld, Chicago: In the case which Dr. Burch reported I do not believe that the diagnosis could have been made intra vitam, although the patient presented a few symptoms that could be interpreted as signs of suprarenal changes, namely, fever, severe weakness with anorexia, and during the last days of his life a peculiar mottling of the skin. From the pathologist's point of view the case is extremely interesting. *A priori* pathologists are reluctant if they are confronted with a so-called primary bilateral carcinoma of the suprarenal glands, because tumors of the suprarenal glands are much more frequently of secondary nature. Dr. Burch was kind enough to let me have sections of the metastasis in the liver and of the growth in the orbit. From these two specimens I would have made the diagnosis of metastatic very malignant sarcoma which most likely originated from the skeleton or from the lungs. Dr. Burch therefore had to fulfil two requirements; first, to show that no other tumor was present which could more likely be considered the primary focus; second, to demonstrate by means of the modern staining methods, for instance, Maximoff's technic, that the cells of the suprarenal tumor could be derived from the normal structure of the suprarenal glands. From the histologic description I believe that Dr. Burch has succeeded in fulfilling the second requirement. As to the possibility of the presence of a tumor of the bones or of the lungs, I should like to hear Dr. Burch's personal opinion. If there were no other tumors that could be considered as the primary lesions, then we have to accept this case as one of the very rare suprarenal carcinomas which from the resemblance of their metastasis to sarcomas have been and probably still should be classified as mesotheliomas.

Dr. Parker Heath, Detroit: Dr. Burch's case illustrates a close connection between general pathologic changes and pathologic changes in the eye. Pathology has supplied us with an involved literature about hypernephroma and other malignant tumors in the kidney region. The original position taken by Grawitz that these growths are suprarenal cortical rests in the kidney has been elaborated. Stoerk concluded that some of these tumors have a relation to both primitive kidney and suprarenal cortex. According to Wilson, they are nephrogenic mesotheliomas. After some time, clinical observations disclosed differences in constitutional reactions. This has led to three convenient, though incomplete, clinical groups: (1) the Grawitz neoplasm, a nephrogenic mesothelioma; (2) the true cortical suprarenal type, sometimes with associated constitutional changes, and (3) the true mixed tumor of the infantile kidney, a renal blastoma, causing early death of the patient. Suprarenal tumors tend to metastatize to the bones of the pelvis, the lungs and, by the laws of chance, to the orbit. Frequently study of the metastatized material from the renal blastoma shows cell resemblance to that of sarcoma, sometimes that of rhabdomyosarcoma. Secondary constitutional changes follow irritative lesions of the suprarenal cortex, as hirsutism, increase in muscular power, secondary sex manifestations, sudden high hypertension, early degeneration of the blood vascular system and polycythemia. These mesodermal reactions as remote, indirect effects of irritative malignant tumors of the suprarenal cortex are of greatest value in the differential diagnosis and management of the patient.

Dr. F. H. Verhoeff, Boston: I shall confine my remarks to the metastatic neuroblastomas of the orbit. The author stated that the neuroblastomas arising in the suprarenal glands contain rosettes and that this suggests a relation between these tumors and retinoblastomas. I want to point out that just the contrary is true, because the rosettes in these tumors are entirely different in nature from the rosettes of retinoblastomas. I shall now show some slides showing different types

of rosettes. The first slide shows the rosettes of a suprarenal neuroblastoma, metastatic in the orbit. These rosettes really represent attempts to form sympathetic ganglions. There is no membrane here at all; the space is filled with fine fibrils, embryonic nerve fibrils. Such rosettes do not occur in any other kind of tumor, and they do not occur very often in neuroblastomas. I have found them in only two of seventeen of these tumors. The second slide shows the rosettes of a retinoblastoma. Here around the lumina is a membrane through which often project embryonic rods and cones. The third slide shows rosette-like structures in a true glioma of the optic nerve. Here the cells have arranged themselves around blood vessels. These may be called pseudorosettes.

Dr. Frank E. Burch, St. Paul: Since this paper was written, in the second volume of Henke and Lubarsch's handbook, which has just appeared, I believe there are additional cases of metastasis reported. I am grateful to Dr. Kronfeld for drawing attention to certain points of this paper. I would say that the brain was carefully studied and no evidence found to explain the convulsive attack. A roentgenogram of the long bones was not made. I am sorry the microscopic slide sent Dr. Kronfeld was one from the metastasis in the liver instead of the primary growth in the suprarenal glands. The pictures show the histologic resemblance. The study of the visual fields was mentioned in the text. It shows almost complete loss of the nasal field, contraction of the temporal field, but no scotoma when the patient was first seen. After he came to the hospital he was too ill to have his visual fields taken. I am grateful to Dr. Heath for calling attention to the group of medullary tumors found in children, and to Dr. Verhoeff for correcting the mistake in pathology as regards retinoblastomas and neuroblastomas, which to him is quite obvious.

EYES OF IRRADIATED HUMAN EMBRYOS

FURTHER OBSERVATIONS *

ISADORE GOLDSTEIN, M.D.
AND
DAVID WEXLER, M.D.
NEW YORK

In previous communications [1] we noted the constancy with which rosettes occur in the eyes of human embryos when large doses of x-rays were applied to the abdomen during the second month of pregnancy. The embryos studied varied in age from 3½ to 7 months. In a fetus that had managed to survive the effects of irradiation until 7 months, besides the conversion of large portions of the retina to rosettes and poorly differentiated tissue there were failure of fusion of the layers of the optic stalk, which appeared to have attempted to differentiate into retina, and, in addition, retardation of the development of the anterior part of the eye, so that the ciliary processes and iris were exceedingly rudimentary. The effects were, then, a curious mixture of stimulation or proliferation of the posterior segment and inhibition or retardation of growth in the anterior segment of the globe.

In two older embryos (6 and 6½ months) subsequently obtained we attempted, by serial section, to reconstruct the rosettes with a view to determining their exact mode of origin from the cellular layers of the retina. That they are related to stimulation and proliferation of the posterior part of the globe cannot be doubted. It remained to be determined whether they are cystic or simply foldings in the outer layers of the retina. Other abnormalities, such as defects in the fetal cleft and abortive ciliary processes and iris, depend apparently on the time of exposure to irradiation. They were not noted in these two cases. The dosage in all instances being fairly constant, it would appear that associated developmental defects correspond to application of the x-rays at the "critical period," either preceding or simultaneous with the differentiation of the anterior ectodermal layers.

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* Submitted for publication, Oct. 22, 1931.

* From the Laboratories and Ophthalmological Division of the Mount Sinai Hospital.

1. Goldstein, I., and Wexler, D.: Tr. Am. Acad. Ophth., 1930, p. 140; Rosette Formation in the Eyes of Irradiated Human Embryos, Arch. Ophth. **5**: 591 (April) 1931.

The observations in cases to be reported pointed to a peculiar origin of the rosettes from the nuclear layers, quite apart from the derivation from neuro-epithelium noted in our previous reports. Also, a hemorrhage was seen within the sheath of a 6½ months embryo, and its effect on the adjacent nerve tissue was studied in serial section.

MICROSCOPIC STUDY

Figure 1 shows a collection of eosin-staining serum and degenerated blood elements occupying the arachnoid space on either side of the nerve. Traces of blood could be made out as far as the lamina cribrosa. In

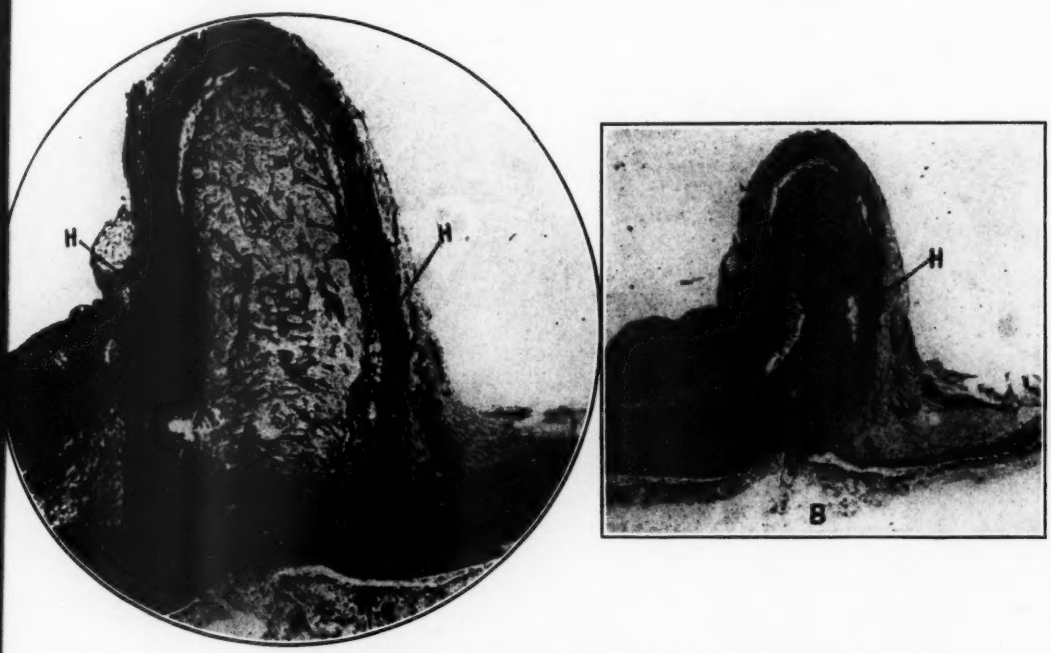

Fig. 1.—Section through the pit of the nerve, showing hemorrhage (*H*) in the optic sheath. *A*, blood serum in the sheath with an intact nerve. *B*, hourglass compression of the nerve by blood; partial necrosis of adjacent nerve fibers (a fetus from 6½ to 7 months of age).

figure 1 *B*, at a different level, the blood was considerably denser and had presumably compressed the nerve at this point to a considerable extent. A few of the nerve fibers had disintegrated and had been shed into the hemorrhagic area, while a few blood cells could be made out in the nerve tissue itself.

A section of altered retina in a 6½ months fetus is shown in figure 2. No intact neuro-epithelial elements were seen. Differentiation of the poorly formed external nuclear layer into cone nuclei, or of the cells

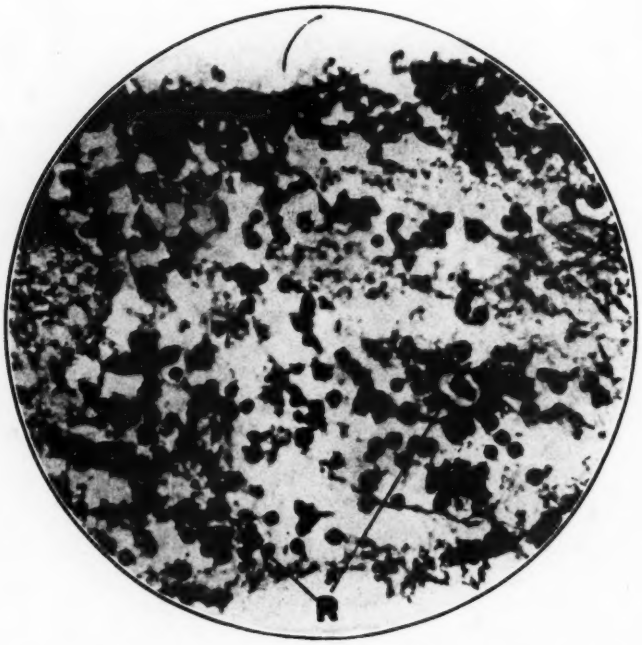

Fig. 2.—Rosettes (*R*) in the anterior layers of a greatly altered retina. The nuclear layers have disintegrated into cells which have wandered forward (a 6 months fetus).

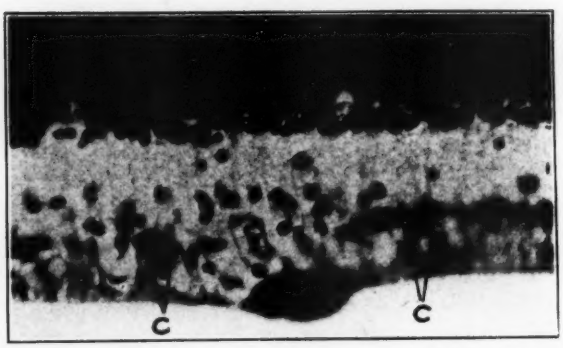

Fig. 3.—Nodule composed of cells resembling those of the inner nuclear layer, causing the internal limiting membrane to bulge. Similar cells (*C*) have migrated into the ganglion cell layer (a 6 months fetus).

lying more anteriorly into those of the amacrine or bipolar cell type, was not possible. For the most part they were homogeneous in structure: round, rich in chromatin and deeply staining. They were loosely scattered throughout all the layers of altered or poorly differentiated retina. The rosettes pictured lying anteriorly were visible in eight sections studied serially. No connection with the vestiges of the neuroepithelial layer could be established. Apparently, their formation was separate and entirely within the retina. They consisted of a membrane staining densely with hematoxylin and bordered with feebly staining structures resembling cones and possibly rods. The cells were arranged irregularly about the cones for the most part. In other instances, the arrangement of cones and cells was more regular. Staining with phosphotungstic acid hematoxylin failed to reveal glia cells or glia fibers.

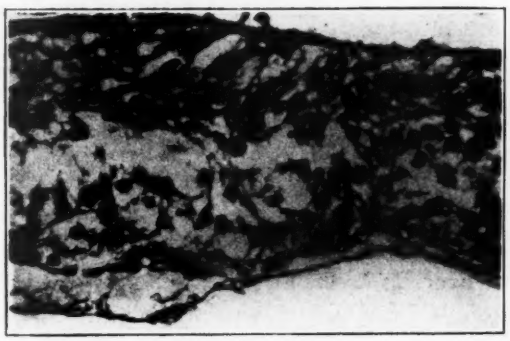

Fig. 4.—Loss of identity of the separate structures of the retina, showing a loose irregular arrangement of cells. The adjacent portions of the retina are normal (a 7 months fetus).

No inflammatory cells could be made out. Ganglion cells and nerve fibers were absent.

A nodule composed of cells resembling those of the internal nuclear layer in a section of normal retina is shown in figure 3. Scattered throughout the ganglion and nerve fiber layer were similar small round cells, apparently having migrated, while enough had accumulated at one point to cause the limiting membrane to bulge.

An extremely undifferentiated portion of retina is shown in figure 4. Few cells bearing a resemblance to even the early type of cell comprising the nuclear layers were made out. If anything, the large, vesicular, poorly chromatized cells found in the outer portion resembled more closely the round cell of the undifferentiated inner neuroblastic

layer (Mann [2]). These cells were enmeshed in a loose glia framework. No increase of glial tissue was found with the glia stains.

COMMENT

There is little to comment on regarding the hemorrhage in the sheath of the irradiated fetus, except perhaps the reaction of the nerve tissue in the presence of disintegrating blood. The hourglass compression and the evidence of solution of some of the fibers may be consequences of the poor resistance of immature tissue. Certainly, such effects are not noted in optic sheath hemorrhages in the adult. The rôle of irradiation in its production can only be speculated on.

Regarding the rosettes, from their presence in the anterior retinal layers and their independence from the structures of the neuro-epithelium, as shown in serial section, one must consider an entirely separate mode of origin for these as against those found in the outer layers. From studies of the early cases of microphthalmic eyes and globes with chorioretinitis and high grade degeneration (Wintersteiner,[3] Brown Pusey,[4] Murakami [5]), in which rosettes were found close to the external limiting membrane, it was concluded that these structures formed as a result of the infolding of the neuro-epithelial layers. This was especially prone to occur where gliosis had supervened, the glia fibers exerting traction or contracting the outer layers of the retina into folds. However, in the embryos studied no evidence of inflammation or an increase of glia tissue was made out. In many portions of the retina where rosettes occurred, alterations were so pronounced that a definite neuro-epithelium could hardly be said to exist. In others, in which rosettes occupied the nerve fiber layer in the presence of intact layers of the retina, no connection could be established with the neuro-epithelium. In view of this, the influence of folding of the outer layers or of gliosis in the origin of the rosettes can be dismissed as far as these isolated rosettes are concerned. Neither are they composed in any part of glia fibers.

To explain rosettes in the anterior layers independent of formed neuro-epithelium and cone cells, one must look to the cellular condition of the altered retina. The scattering of cells from the nuclear into the forward layers is presumably one of the influences of x-rays. Whether

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2. Mann, Ida C.: Development of the Human Eye, New York, The Macmillan Company, 1928, p. 97.

3. Wintersteiner, Hugo: Das Neuro-epithelioma retinae, Leipzig, 1897.

4. Pusey, Brown: Retinal Rosette Formations of Neuroglia in Inflammatory Processes, Arch. Ophth. **32**:325, 1903.

5. Murakami: Rosette Formation in Disseminated Choroiditis, Arch. f. Ophth. **53**:439, 1902.

this occurs immediately on irradiation (in the second month of fetal life) or at a later period is difficult to say. It is not impossible that even after migration these cells carry with them their potential power of developing into cone cells and also into processes, and that the dense limiting membrane is a condensation of their basement membranes. This property could be ascribed to the dislocated cells of the outer neuroblastic layer, although it is conceivable that under the influence of irradiation those of the inner layer might acquire this property as well. The migratory property of the cells is shown well in figure 3. Here, in the presence of normal retina, many cells of the inner nuclear have migrated into the ganglion layer, even to the extent of forming a nodule behind the internal limiting membrane.

Clinical Notes

A SIMPLIFIED RETINAL MEASURING GRID*

ROBERT K. LAMBERT, M.D., NEW YORK

Ophthalmologists occasionally find themselves in need of accurate records concerning the size of structures on the living retina. This need is perhaps of greatest importance if a lesion is encountered with some of the characteristics of a neoplasm, when a slight increase in size may verify the diagnosis. It is also, however, of interest to procure an exact record of the diameter of the nerve head if questionable papilledema or blurring of the margins is present. The size of hemorrhages and exudates and the width of blood vessels are also sometimes of importance. Such measurements are also useful for localization of lesions and for descriptive purposes.

Measurements on the retina can be made by means of the Gullstrand ophthalmoscope fitted with a micrometer ocular, or by photographing, or having an accurate drawing made of, the fundus. These methods unfortunately are not available to all practitioners, nor are they feasible in every case.

The method here described is similar to that employed with the Keeler ophthalmoscope (devised by O. Gayer Morgan). It consists of the use of a grid, which is projected on the retina by an illuminating mechanism of the ophthalmoscope in the same fashion that a lantern slide is projected on a screen.

The advantage of this method is its extreme simplicity—a small cap containing the grid being placed over the ophthalmoscope condensing lens in instruments of the May or Morton type. From the image so obtained, changes in size can be followed, and the exact size of structures on the retina can be readily determined.

CONSTRUCTION

Attempts were first made to etch a grid either directly on the ophthalmoscope condensing lens or on a glass plate to be held in position over it. The very fine etched lines, however, then had to be made sufficiently opaque to show up clearly on projection, which was a difficult and unsatisfactory procedure. The grid was finally constructed photographically in the same manner that replica diffraction gratings are made. Reductions to the proper size were made of standard grids (used in halftone photo-engraving) on photographic plates with

* Submitted for publication, Dec. 3, 1931.

* Read before the New York Academy of Medicine, Section of Ophthalmology, Nov. 16, 1931.

* From the New York Eye and Ear Infirmary.

removable gelatin emulsions. A small piece of the emulsion carrying the duplicate grating was then mounted between two pieces of optically flat glass (blood-counting cover glass is satisfactory) in a metal cap built to fit over the ophthalmoscope condensing lens. The glasses are held up by a circular shoulder within the cap under the lower of the

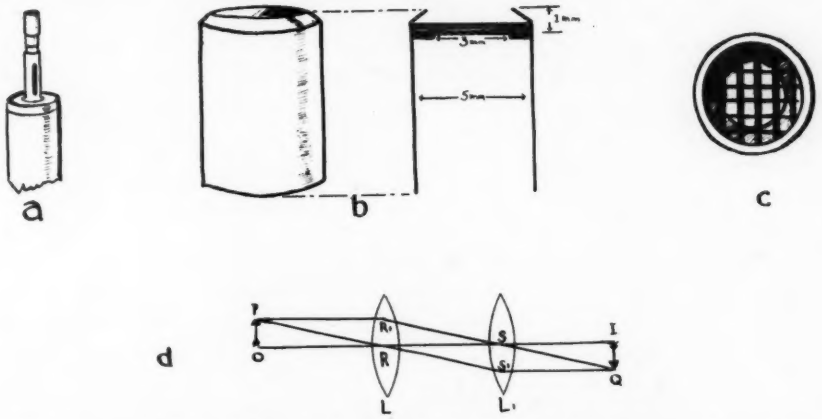

Fig. 1.—*a*, portion of the ophthalmoscope, showing the grid cap in place over the condenser; *b*, enlargement of the grid with dimensions; *c*, appearance of the grid from above; *d*, optical system involved (see text).

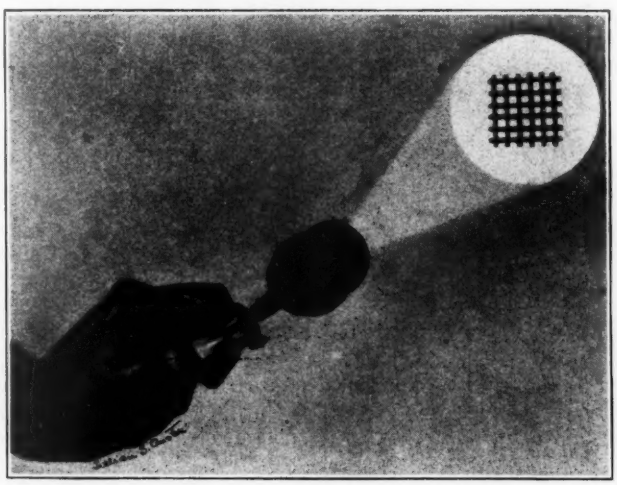

Fig. 2.—The grid focused on a white background over 1 meter distant.

two, and a beveled edge is turned down over the upper. The dimensions of the cap can be obtained from figure 1.

USE OF THE GRID

After the grid cap has been placed on the condensing lens cap, as shown in figure 1, *a*, the ophthalmoscope is raised or lowered so that the image of the grid is in focus approximately at infinity (fig. 2).

For practical purposes, the image can be focused on a white wall farther than 1 meter from the instrument. When the instrument is so adjusted, the grid is in the focal plane of the ophthalmoscope lens, or (in the May ophthalmoscope) 1 cm. from it. As the rays leaving any point on the grid emerge parallel, they will be brought to a focus on the retina of an emmetropic eye, under cycloplegia.

Consequently, if the eye to be examined is relatively emmetropic, variations in distance from the eye (within the order of a few centimeters) will not affect the size of the image. Knowing the size of the grid, the size of the image can be readily calculated by a simple ratio, derived as follows:

1. In figure 1, *d*, the ophthalmoscope lens *L* gives an image of the grid (*OP*) at infinity, i. e., *OP* lies in the focal plane of *L*, or the distance $OR = f$.

Fig. 3.—Appearance of the large grid projected on the nerve head.

2. In the normal or corrected patient's eye, with accommodation relaxed, parallel rays are converged to a point on the retina. (The eye is focused at infinity) i. e., $SI = F$.

3. Triangles *OPR* and *IQS* are similar, hence

$$\frac{OP}{IQ} = \frac{f}{F} \text{ or } IQ = \frac{F}{f} \times OP$$

Example:

$$\text{Distance between two grating lines on the retina (in mm.)} = \frac{\text{23.8 mm. (taken as focal distance of the normal eye)}}{\text{10 mm. (focal distance of ophthalmoscope lens)}} \times \text{Actual distance between two grating lines (in mm.)}$$

The error introduced by slight deviations from emmetropia can be sufficiently overcome for clinical purposes by always holding the ophthalmoscope as near to the eye as possible.

One or two points should be mentioned in closing. Up to the present I have found grids of 100 and 215 lines to the inch to be the most convenient for measuring respectively large and small structures. Grids with a relatively heavy line are used as they are more easily seen when projected on the brilliantly illuminated fundus. The lines on the nerve head itself are sometimes seen with difficulty, but it is always possible to measure the width of the disk by observing the lines just to one side of it (fig. 3).

The grids can be obtained from E. B. Meyrowitz & Company, New York.

DISCUSSION

DR. BENJAMIN FRIEDMAN, New York: I should like to know how the grid is made.

DR. HENRY H. TYSON, New York: Dr. Lambert's grid appears to be a modification of the Keeler ophthalmoscope of London, with the advantage of simplicity and economy. However, it lacks that refinement of the Keeler instrument which gives you a grid reflecting very fine squares with lines as fine as those composing a spider web. With Dr. Lambert's grid, the apertures are round instead of square, with too much white reflex showing. If he can improve his grid so as to give the same effect as the Keeler instrument, it would be worth while.

DR. ROBERT LAMBERT: In answer to how the grid is made, it is made either by a direct reproduction of a halftone screen that is used in photographic work, which is made in varying sizes of a unit from 1 to 0.03 inch (2.5 to 0.075 cm.), or else reductions of halftone screens are made so that any size unit can be obtained, and the emulsion that is obtained on the photographic negative is transferred to two pieces of glass.

In regard to whether the line could be made finer, it could be made very much finer, and the cap that I am passing around has one that is practically impossible to see with the naked eye. The objection to using a very fine line on the fundus is that the amount of light present makes the line difficult to see, and we find that for clinical purposes it is easier to work with a heavy line.

THE TECHNIC OF DACRYOCYSTORHINOSTOMY*

WEBB W. WEEKS, M.D., NEW YORK

The object of this operative procedure is to make a permanent opening between the lacrimal sac and the nasal cavity by means of mucous membrane flaps from these two cavities. The procedure is a modification of the Toti-West operation as carried out by Dupuy-Dutemps.[1] It is

* Submitted for publication, Dec. 10, 1931.

* Read before the Section of Ophthalmology, New York Academy of Medicine, Nov. 16, 1931.

1. Dupuy-Dutemps and Bourguet: Ann. d'ocul. **158**:241, 1921.

frequently done by French ophthalmic surgeons. Marin Amat,[2] in a recent ophthalmological journal, reported two hundred and fifty cases seen in the past five years.

In the main, the procedure is indicated in cases of epiphora due to an established obstruction of the lacrimal duct. In chronic dacryocystitis, with little ectasia of the sac, no fistula and with the walls of the sac not too thickened by scar formation, it affords a good result. Contraindications include any obstruction of the puncta or canaliculi, active infection of the sac or its walls and a high deflection of the septum to the side of the proposed operation, especially where the nasal mucous membrane is chronically congested, infected and friable.

PROCEDURE

The anesthesia used for this procedure is important. Aside from that used in an operation for removal of a sac, namely, along the line of skin incision and deep

Fig. 1.—Outline of the bony orbital margin; the anterior lacrimal crest area gives the line of the incision. The deep infiltration catches the nasociliary nerve at the anterior ethmoid foramen. *1* indicates the deep infiltration; *2*, injection of the dome; *3*, injection of the neck, and *4*, the line of incision.

to the dome and to the neck of the sac, 0.5 cc. of procaine hydrochloride and epinephrine is injected so as to lift the nasal mucous membrane up over the area just in front and below the middle turbinate. A similar amount is injected so as to block the nasociliary nerve. This is accomplished by passing the needle of a hypodermic syringe 2 cm. posteriorly along the line of suture between the frontal and the ethmoid bone.

An incision is then made down and through the periosteum just medial to the margin of the anterior lacrimal crest, and is carried from a point 3 mm. above the canthal ligament down and out following the curve of the crest for 2 cm. A lacrimal retractor is then inserted. A special periosteal elevator pushes back the periosteum medially for 5 mm. and laterally around the crest off the medial

2. Marin Amat, M.: Arch. d'opht. **48**:509, 1931.

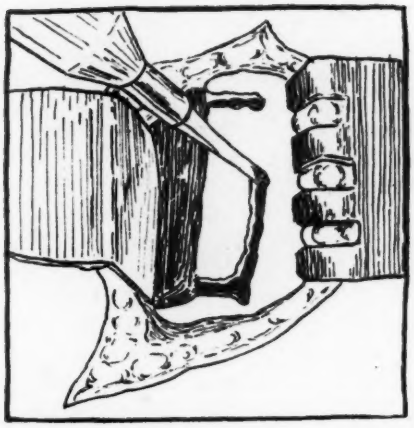

Fig. 2.—The reflection of the periosteum, exposing the anterior lacrimal crest and the fossa. Round dental burrs cut through the crest, making an outline, then these were connected with a lateral cutting burr, as shown. (Figures 2, 3 and 4 follow the illustrations of Duverger and Velter [Thérapeutique chirurgicale ophthalmologique, Paris, Masson & Cie, 1926] with some changes.)

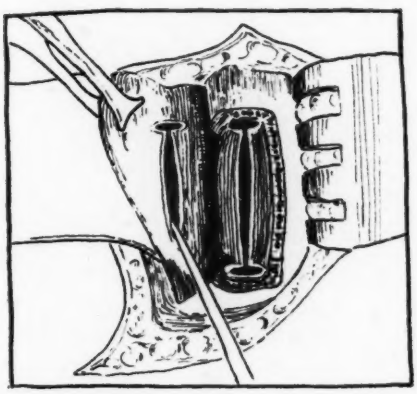

Fig. 3.—The bony fragment removed. The nasal mucous membrane was exposed and incised. Similarly, the medial wall of the lacrimal sac was incised.

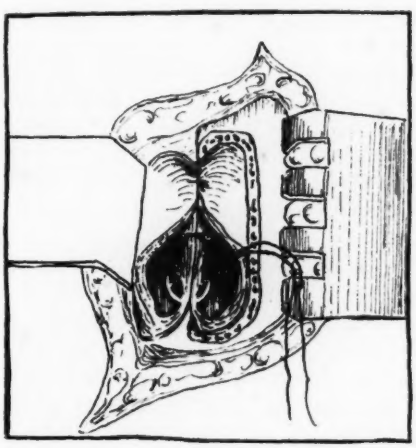

Fig. 4.—The suturing of the nasal and lacrimal mucous membrane flaps.

wall of the lacrimal fossa to the posterior lacrimal crest from the lacrimal duct inferiorly to just above the dome of the lacrimal sac superiorly. This lateral periosteum with the internal canthal ligament containing the sac is held well laterally by a moderately deep tissue retractor. With a dental engine with dental burrs, holes are drilled through the maxillary bone, forming the anterior lacrimal crest to the nasal mucoperiosteum 4 mm. from the crest, from the level of the dome above to the level of the lacrimal duct below. These holes are connected by a lateral cutting dental burr; the upper and lower crest margins are cut through. With a mallet and small bone chisels, the bony fragment making up the anterior lacrimal crest and the lacrimal bone back to the posterior lacrimal crest are removed. This exposes the nasal mucoperiosteum surrounded by a bony frame. Any rough edges are rongeured smooth.

Slightly posterior to the middle of this membrane an incision is made from the upper to the lower bony margins. At each end, cuts are made perpendicular to the first cut, making an anterior and a posterior nasal mucoperiosteal flap. After dilating the lower punctum, a probe is passed into the sac along the lower

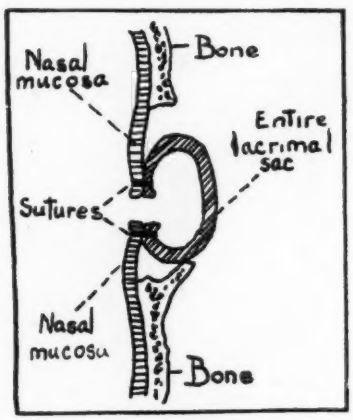

Fig. 5.—Cross-section of the results of the uniting of the two membranes. (After Dupuy-Dutemps and Bourguet: Ann. d'ocul. **158**:241, 1921.)

canaliculus. This gives the position of the canaliculi opening into the sac. Incisions, similar to those made in the nasal mucoperiosteum, are made in the nasal wall of the lacrimal sac.

With a Yankauer septal needle, three silk sutures are passed through the margins of the posterior nasal mucoperiosteum and the posterior lacrimal sac flaps from above downward and tied. The anterior flaps are similarly united. Interrupted catgut sutures connect the periosteal margins, closing off the lacrimal fossa and relieving any tension on the sutures in the wall of the sac.

Interrupted silk sutures close the skin wound, and a pressure dressing is applied over the sac area. This dressing is left on for five days; then the sutures are removed. On the following day, the dressing is left off. The patients are advised not to blow the nose.

After ten days, gentle irrigation through the lower canaliculus is done, and drops of mercurochrome-220 soluble into the lower culdesac are used twice daily for a week. So far, these cases have shown no more reaction, and there is no more deformity than that seen in cases in which extirpation of the sac is performed. No pus can be expressed from the sac, and the epiphora is relieved.

COMPLICATIONS

In the eight cases in which this technic was followed, the following complications were encountered:

1. Hematoma of the orbit followed a hypodermic needle puncture of a branch of the angular vein communicating with the superior ophthalmic vein. As the lids became tensely swollen and proptosis occurred in the eye, a pressure bandage was applied, a narcotic was given, and the patient was kept quiet in bed for two days. No harm resulted, and the operation was carried on at the end of a week.

2. An anterior ethmoid cell was encountered, which delayed operation because of the numerous bony fragments that had to be removed.

3. Difficulty was met with in making and uniting the nasal mucous membrane flaps because a space too small in which to work had been made.

4. A congested, friable nasal mucous membrane (due to pressure of a high nasal septal deviation) did not permit grasping with forceps for the insertion of sutures. This mucous membrane was cut away, and the medial wall of the lacrimal sac was removed. A pressure bandage then forced this area well nasally. Granulation tissue was present intranasally for a month. Within two months the patient did not complain of epiphora.

Marin Amat reported in two hundred and fifty cases a delayed secondary hemorrhage that almost exsanguinated five patients because of the difficulty in stopping the hemorrhage from a section of a branch of the nasociliary artery in the lower end of the wound through the nasal mucous membrane.

DISCUSSION

Dr. Francis W. Shine, New York: I have not had any experience recently with this procedure, but several years ago in my clinic at the Infirmary we had several cases. I think I operated on one patient myself, but the other operations were done by members of the Ear Staff, Dr. Blackwell and Dr. Sowers, by the Mosher method, which is somewhat different from this one. As far as I know, those three, or possibly four, patients obtained a good result for the time being. They were not watched for any length of time, except one who came back the other day all the way from Philadelphia to tell me what a good job had been done. That operation was evidently successful. I think that the operation can be done successfully, and that good results can be obtained.

News and Notes

EDITED BY DR. JOHN HERBERT WAITE

PERSONAL

Dr. Thomas B. Holloway, 1819 Chestnut Street, Philadelphia, has been elected a member of the Board of Directors of the National Society for the Prevention of Blindness to succeed the late Dr. George S. Derby, of Boston. Dr. Holloway has served at Wills Hospital, Philadelphia General Hospital and the Maternity Hospital in Philadelphia. He is a co-author (with Dr. George de Schweinitz) of "Pulsating Exophthalmos." He is a member of the American Medical Association, American Ophthalmological Society and American Academy of Ophthalmology and Oto-Laryngology.

Prof. E. Seidel, of. Heidelberg, has been called to Jena as director of the Eye Clinic, to replace Professor Löhlein.

Prof. J. W. Nordenson, of Uppsala, has succeeded Prof. A. Dalén (July, 1931) as director of the University Eye Clinic at Stockholm.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Conjunctiva

EPITHELIAL XEROSIS OF THE CONJUNCTIVA. G. CAOCCI, Arch. di ottal. **38:** 528 (Sept.) 1931.

The literature on conjunctival xerosis is reviewed, and a case is reported. The patient was a man of 62, who had noted a white spot on the bulbar conjunctiva for the past year. It developed soon after a slight injury to the eye with a twig. He showed no other physical signs of malnutrition, and his diet was normal. The white patch measured 6 by 7 mm., was roughened and was raised slightly above the otherwise normal conjunctiva. Vision in each eye was 6/10 with correction. Smears and cultures of the white material showed enormous numbers of xerosis bacilli and a few cocci. The area was excised, and sections showed irregular thickening of the epithelium, with hemorrhages in the subconjunctival tissue and some perivascular round cell infiltration. The epithelium showed that the superficial cells were continually being desquamated, necessitating a hyperplasia of the deeper epithelial cells to replace them. Granules of keratohyalin were seen in the subconjunctival tissue. At the site of greatest epithelial change, the underlying elastic tissue was markedly swollen and degenerated. After excision of the plaque, the epithelium returned to normal and remained so until two years later, when the patient was last seen. On account of the absence of signs of malnutrition and the involvement of only one side, the author believes that the traumatism described was at least in part responsible for the condition.

S. R. GIFFORD.

TWO CASES OF LYMPHANGIOMA OF THE CONJUNCTIVA AND OF THE BUCCAL MUCOSA. O. SCHOEPFER, Klin. Monatsbl. f. Augenh. **86:** 336 (March) 1931.

Lymphangioma of the conjunctiva is a malformation, usually congenital and mostly located in the conjunctiva of the globe. Two cases of this type in girls, aged 15 and 20, respectively, are reported in this paper. The right eyes were afflicted and amblyopic; extensive lymphangiomas of the mucous lining of the right side of the mouth were present, crossing slightly the median line. This coincidence prompted the author to believe that the malformations developed in early life, and that the conjunctival and buccal lymphangiomas were originally one, but separated at the time when the maxillary and frontal processes developed. The occurrence of orbital defects coupled with the trend toward cleft palate supports this view. The diagnosis is facilitated by the presence of multiple changes. The histologic examination of both cases showed cavernous lymphangioma. The vacuoles were covered with a single layer of flat endothelial cells and were filled with a finely granulated mass, containing no cells and staining faintly with eosin.

K. L. STOLL.

General

DIFFUSE HYPEROSTOSIS OF THE SPHENOID WITH GREAT ENLARGEMENT OF THE ANTERIOR CLINOID PROCESSES: OCULAR MANIFESTATION. H. FERRER, Am. J. Ophth. **14:** 412 (May) 1931.

A woman stated that since girlhood she had seen poorly with the right eye, and that vision continued to diminish in spite of treatment. Examination showed vision of counting fingers at 2 feet in the right eye, and of 20/50 in the left eye. The pupils were active to light and in accommodation. The right optic disk was pale and slightly excavated. Tension was 70 in the right eye, and 26 in the left (McLean). The right field showed a partial central scotoma, particularly for red and green; otherwise, the fields were normal. The hypertension in the right eye yielded to miotics and did not recur. The Wassermann reactions of the blood and spinal fluid were negative. Roentgenography disclosed hyperostosis of the body of the sphenoid and its wings. Only the right optic nerve was affected. Injections of bismuth were given. Three years later an x-ray film disclosed no increase in the size of the tumor. The author recalls that these tumors remain stationary when body development has been completed.

W. S. REESE.

General Diseases

SIGNIFICANT HEMORRHAGIC RETINAL LESIONS IN BACTERIAL ENDOCARDITIS (ROTH'S SPOTS). W. B. DOHERTY and M. TRUBEK, J. A. M. A. **97:** 308 (Aug. 1) 1931.

The authors' conclusions are drawn from a study of the lesions of the eyegrounds occurring in bacterial endocarditis, particularly the subacute form, studied in the wards of the Fourth Medical Division, Bellevue Hospital, and in the wards and laboratories of the Newark City Hospital.

Their conclusions are as follows:

The characteristic elliptic retinal hemorrhages with white centers occur in the bacterial endocarditides, acute and subacute, and in the severe anemias, notably pernicious anemia.

The discovery of this lesion because of its significant appearance may aid in early diagnosis.

The lesion occurs in both eyes, with a little greater frequency in the left eye in their series.

The lesion has little prognostic value in subacute bacterial endocarditis; in several instances it had appeared and disappeared in successive crops many months before death.

They suggest that the designation "retinitis of endocarditis" might after further study be appropriately applied.

W. ZENTMAYER.

Hygiene, Sociology, Education and History

SOCIAL SERVICE AT THE MASSACHUSETTS EYE AND EAR INFIRMARY. G. S. DERBY, Am. J. Ophth. **14:** 644 (July) 1931.

The author stresses the importance of social service, especially in such diseases as ophthalmia neonatorum, phlyctenulosis, tuberculosis, interstitial keratitis and glaucoma.

W. S. REESE.

AN OCULIST WHO BECAME POPE JOHN XXI. D. D'AMICO, Arch. di ottal. **38:** 564 (Sept.) 1931.

Pietro Ispano was born in Lisbon about 1226, the son of a physician. He studied in Paris, especially philosophy, which included the natural sciences, and received his Master's degree there. He taught at Sienna for a time, and in 1261 became attached to Cardinal Ottobono Fieschi, whom he attended as personal physician and accompanied on his journeys as papal legate. At the death of Adrian V, who was the last of three popes during one year, in 1276, Pietro was elected pope, assuming the name of John XXI. He lived only eight months after this, during which time he was active in international affairs and gave great encouragement to students. His book "Thesaurum Pauperum" ("The Treasure of the Poor") was a popular treatise on medicine for the use of the layman, and contained directions for using the herbs and medicaments then in vogue. In another work he discussed hemeralopia, and another contained a discussion of current ideas on psychology. The work that is of most interest to ophthalmologists was his "Trattato degli Occhi." This considered the anatomy and physiology of the eye, its diseases and their treatment. He believed the crystalline lens to be the organ of vision, and that disturbances of vision were due to obstruction of the central canal which transmitted the visual fluid to the brain. He followed the Arabic humoral theory of disease. One of his collyria was so famous that it was used two centuries later by Michelangelo for an ocular disorder which occurred while he was at work on the Sistine Chapel.

S. R. GIFFORD.

Instruments

OPHTHALMO-MANOMETRY. W. S. DUKE-ELDER, P. M. DUKE-ELDER and J. C. COLLE, Brit. J. Ophth. **15:** 575 (Oct.) 1931.

The authors first point out that the tonometer can in no sense be accepted as efficient for accurate experimental registration of the intraocular pressure, and that it is only by the method of manometry, whereby the contents of the globe of the eye are put into direct relationship with a recording manometer by means of a cannula introduced into the anterior chamber, that this can be attained. They then describe an instrument that meets the essentials of a good manometer; that is, it inscribes a curve of sufficient amplitude to show small changes in gradient. responds without appreciable lag and reproduces variations of pressure correctly as regards amplitude and phasic relations. The apparatus represents a combination of the compensatory manometer with an optical manometer.

W. ZENTMAYER.

Lens

RECOVERY OF VISION AFTER TWENTY-SEVEN YEARS. NORMAN FLEMING, Brit. M. J. **2:** 1084 (Dec. 12) 1931.

With this somewhat misleading title the author reports an operation for double lamellar cataract in a woman 35 years of age. He draws attention to the defective enamel of her teeth, which is so frequently

associated with lamellar cataract, and to the fact that the exposed dentine is worn away in adults.

The operation was performed by needling, which was repeated three times in one eye and four times in the other. No complications ensued, and the resulting vision, with correcting glasses, was 6/6 partly. Restoration of vision has made an enormous improvement in the patient's general health and general outlook.

A. KNAPP.

CONCERNING CERTAIN TYPES OF "CATARACT EN ROSACE." J. NORDMANN, Arch. d'opht. **48:** 392 (June) 1931.

The term "cataract en Rosace" is generally applied to a group of traumatic cortical cataracts, most often posterior. These opacities have a stellate form and the appearance of very delicate leaves, each of which is traversed by a denser line resembling the vein of a leaf. The author refers to descriptions of Vogt, Koby and Terrien in which the special characteristics of this cataract have been noted. Some very interesting points about them still remain for explanation. He presents four cases studied with the slit-lamp. The first closely corresponds to Vogt's original case. In connection with his second case he discusses the traumatic origin of this cataract which Handmann does not believe always due to injury. The development of this kind of opacity is discussed in connection with his third case. Most of these cases have been seen very late, and the opacities found situated at some depth in the cortex. It has been argued from these observations that the original lesion is subcapsular and becomes buried deeper in the lens with the laying down of new fibers. The case observed by the author was observed very early after the injury and the lesion definitely noted to be subcapsular. This case supplies the first proof of the hitherto theoretical explanations. The practical application of these observations is discussed in connection with a fourth case in which a patient claimed loss of vision of one eye as the result of a recent accident. The exact localization of the opacity in connection with a more complete history made it possible to determine conclusively that the loss of vision claimed was not due to the recent accident. The author concludes his report by pointing out the characteristics by which this form of cataract differs from the usual case: It is rarely nontraumatic in origin, being commonly the result of a contusion; it is a subcapsular lesion in the beginning, and its exact localization makes it possible to correlate it with a history of injury.

S. B. MARLOW.

STATIONARY SUBCAPSULAR OPACITY OF THE LENS DUE TO CONTUSION. A. FERRARI, Arch. di ottal. **38:** 435 (July-Aug.) 1931.

Experimental work and theories relating to the pathogenesis of traumatic cataract are reviewed. The author reports the case of a child of 8 years who had been struck in the eye by a whip handle. Traumatic mydriasis was present, with two ruptures of the sphincter. The cornea and sclera were uninjured. Vision was reduced to 1/6 by a thin triangular opacity in the pupillary area of the lens. The slit-lamp showed an intact anterior lens capsule, the thin layer of opacity occupying the

cortex just beneath the capsule. Small globules were to be seen in its central portions, and surrounding the central opacity were numerous fine refractile dots. The condition remained unchanged for seven months. The opacity can best be explained as due to the trauma exerted on the epithelium of the lens, which in the axial area is oldest and may undergo degeneration without a rupture of the capsule itself. The lens fibers may also have been directly injured. (Bibliography.)

S. R. GIFFORD.

Methods of Examination

W. R. HESS METHOD OF GRAPHIC REPRESENTATION OF OCULOMOTOR DISEASES: ITS ADVANTAGES. M. MASSELIN, Ann. d'ocul. **168:** 352 (May) 1931.

The graphic representation of oculomotor diseases, described by Hess in 1908 (*Arch. f. Augenh.*, vol. 62), is described in detail with illustrative cases and charts. It is a method in which the examination is graphically registered on a specially prepared chart. It is simple and is done in broad daylight with a minimum of discomfort to the patient. It is also easily understood by the patient, who is able to note varying features of the diplopia, such as degree and inclination. By giving a quantitative registration of the degree of paralysis, changes occurring during the development of the disease may be easily compared, as it is possible to represent the effects of the deviation from a paralysis by means of the charts. This method, however, does not show the rotating action of certain muscles on the vertical meridian, which would be shown by other methods, such as Hoffmann's and Bielschowsky's, so that it is not meant to supplant other useful methods, but rather to supplement these with the assistance of useful graphic charts.

S. HANFORD MCKEE.

Neurology

A CASE OF OCULAR EPILEPSY. T. H. SHASTID, Am. J. Ophth. **14:** 652 (July) 1931.

A man, aged 45, stated that for thirty-five years he had had attacks, two or three times yearly, during which his thumb and one or more fingers became numb. When the thumb or thumbs became completely insensitive, vision became blurred and diplopia developed. This would last for from ten to fifteen minutes, followed by severe headache.

W. S. REESE.

Ocular Muscles

CONTROL OF THE TENOTOMIZED MUSCLE. M. GOLDENBURG, Am. J. Ophth. **14:** 648 (July) 1931.

The author discusses the condition of the muscles in cases of squint, and the necessity of relieving an antagonistic pull. He does a complete tonotomy and then fixes the end of the cut tendon to the conjunctiva by means of a double-armed suture. This suture is tied loosely or tightly, depending on the amount of effect desired, but not until any other procedure on the antagonistic muscle is finished.

W. S. REESE.

BELL'S PHENOMENON AND THE FALLACY OF THE OCCLUSION TEST. S. V. ABRAHAM, Am. J. Ophth. **14:** 656 (July) 1931.

The author gives an interesting discussion of Bell's phenomenon, and cites his observations in a series of cases. He believes that it is this phenomenon that comes into play in the occlusion test. In six patients tested there was right hyperphoria when the right eye was occluded, and left hyperphoria when the left was occluded. Of eighteen tests in which the right eye was covered, all showed right hyperphoria; in nineteen tests in which the left eye was covered, all but one showed left hyperphoria, and this patient was known to have even more right hyperphoria than the test showed.

W. S. REESE.

Orbit, Eyeball and Accessory Sinuses

EXOPHTHALMOS OF CENTRAL ORIGIN. W. R. BRAIN, Brit. M. J. **2:** 937 (Nov. 21) 1931.

By exophthalmos of central origin the author means exophthalmos occurring in cases in which there is an organic lesion of the central nervous system, and he speaks of the following clinical features:

1. Exophthalmos may be associated with: (*a*) supranuclear ocular palsies, particularly paralyses of conjugate vertical movement and convergence; (*b*) external ophthalmoplegia, and (*c*) internal ophthalmoplegia.

2. The exophthalmos may be unilateral or bilateral, and in the latter case it may be equal or unequal in degree.

3. It may be associated with retraction of the lids or ptosis, in one or both eyes.

4. Exophthalmos may occur with or without enlargement of the thyroid.

5. It may occur with or without disturbance of sugar metabolism.

Encephalitis lethargica is responsible for a number of these cases. Some patients have high blood pressure. One case falls into a group of internal ophthalmoplegia with absent tendon reflexes. Several can be described as nuclear ophthalmoplegia of unknown origin. The most important group is that in which ophthalmoplegia is associated with enlargement of the thyroid, though the relationship is obscure. Some have been described as myasthenia gravis associated with exophthalmic goiter. On clinical grounds, the lesion seems to be situated in the midbrain.

A brief report of ten cases is then added. Five of the patients had enlarged thyroids.

In conclusion, the author states that no sharp line divides exophthalmic goiter from certain cases of acute and chronic lesions of the nervous system, involving especially the upper part of the midbrain.

A. KNAPP.

CONGENITAL CYST OF THE ORBIT OF ETHMOIDAL ORIGIN. P. VANCEA, Riv. oto-neuro-oftal. **8:** 222 (May-June) 1931.

A congenital cyst of the orbit not associated with a developmental anomaly of the eyeball is very rare. The only similar case described by Panas in his treatise of 1894 was ascribed to a lacrimal origin.

The author has a different point of view.

His patient presents a normal eyeball and a cyst situated in the lower and inner angle of its orbit. The swelling appeared soon after birth and was associated with a homolateral congenital anomaly of refraction. Its congenital origin seems, therefore, beyond dispute. He admits the possibility of a fetal and intra-orbital inclusion of ethmoid mucosa because ethmoid cells are already formed in a six months embryo and are developed at birth; their cell walls nearest the orbit are very thin, and the corresponding os planum is often dehiscent between its anterior and posterior two-thirds. In the latter condition the ethmoid cells have wide orbital openings and are separated from the orbital cavity by very thin periosteum.

In fact, at operation the cyst pedicle was followed through to the medial orbital wall, i. e., to those ethmoid cells (agger nasi or preinfundibular cells) which almost surround the lacrimal fossa. Some have called them lacrimal cells, because Stanculeanu (1902) showed that they open into the anterior superior portion of the unciform fossa. This makes clear why an anterior ethmoiditis may produce pain here, made worse by pressure, and why all collections and new formations here tend to appear in the lower and inner angle of the orbit in proximity to the lacrimal sac.

Moreover, no sebaceous glands exist in the mucosa lining the lacrimal passages. Such glands are present in the mucosa of the paranasal sinuses.

Histologic examination of the cyst extirpated from the author's case showed the presence of sebaceous glands, thus confirming its ethmoidal origin. The cyst wall showed a diffuse lymphocytic infiltration and a marked hyaline degeneration at its periphery so characteristic of old congenital cysts and so rare in young persons. These degenerative changes in a young patient (22 years) had not yet become generalized through the entire cyst.

V. R. SYRACUSE.

NASAL NERVE SYNDROME. C. CHARLIN, Arch. de oftal. hispano-am. **31:** 369 (July) 1931.

The nasal syndrome, first described by the author, is characterized by extremely painful ocular crises, entirely out of proportion to relatively mild ocular lesions and accompanied by a profuse nasal hydrorrhea. The ocular lesions may consist of superficial corneal infiltrations, mild iritis and discrete corneal erosions solely visible with fluorescein staining and in slit-lamp examination. These mild objective lesions are accompanied by violent subjective symptoms. The reverse occurs in connection with the nose, in which there is no pain but a marked mucous congestion and a profuse hydrorrhea. There exist, besides, two points of cutaneous pain and extreme tenderness; one, on the nasolabial fold, corresponding to the termination of the internal nasal nerve, and the other, at the internal and superior orbital angle corresponding to the termination of the external nasal nerve. A pathognomonic feature is

the immediate relief from the ocular symptoms, which may have persisted for months in spite of different forms of local treatment, on the application of a cocaine and epinephrine solution to the fore part of the nasal cavity.

The author refers to fourteen cases that he has observed. The diagnosis is easy, once the observer is on his guard. Charlin attributes the syndrome to a neuritis of the nasal nerve, the symptoms being easily explained by anatomic considerations. The most vulnerable point of the nerve is in its course through the bony canal, which it enters after penetration into the ethmoid cells through the internal orbital foramen, where it can be affected by congestive lesions of the mucous membrane lining these cells. The lesion is similar to the retrobulbar neuritis in lesions of the sphenoid sinus. The relief afforded by the application of cocaine and epinephrine is explainable by the reduction of pressure produced by vasoconstriction in the nasal mucous membrane.

C. E. FINLAY.

SPONTANEOUS HEMATOMA IN THE ORBIT. P. VANCEA, Klin. Monatsbl. f. Augenh. **86:** 209 (Feb.) 1931.

A woman, aged 29, suffered from an orbital hemorrhage four days after weaning her baby. It occurred suddenly during the night, causing inability to open the right eye. Exophthalmos, which could not be replaced by pressure of the finger, and edema of the lids with a hemorrhagic focus were noticed the next morning. Orbital inflammation and changes of the general physical condition did not exist. The symptoms disappeared on the same day, only to return during the following night in a more severe form, coupled with diplopia. Perfect restitution had taken place twenty-four hours later; the fundus remained free; the Wassermann reaction was negative, but the diplopia persisted. Similar cases, following interruption of weaning or sudden cessation of the menses, are quoted.

The orbital hemorrhages are explained by thrombocytopenia, which is generally considered a "direct and sufficient cause of prolonged hemorrhages." Sudden partial or total disappearance of the thrombocytes of the peripheral portion of the body may be produced by gelose, peptones, caseins, ovalbumins and other organic colloids, or by silver, platinum, mercury, gold and other anorganic colloids, if they get into the blood circulation. The secretion of the mammary gland was probably absorbed by way of the blood and lymph capillaries after the sudden cessation of lactation in this case.

A predisposing cause for the intra-ocular hemorrhage may be sought in lesion of the endothelium of the blood vessels, limited to the right orbit in this case. It might be termed congenital orbital endothelitis.

K. L. STOLL.

Pharmacology

WHAT CONSTITUTES SATISFACTORY CYCLOPLEGIA? A. DEH. PRANGEN, Am. J. Ophth. **14:** 665 (July) 1931.

The author discusses the question of cycloplegia in refraction and stresses the necessity of testing the accommodation. He gives data of twenty-six cases in four age groups, and makes the following summary:

The object of the paper is to plead for more intelligent and scientific use of cycloplegic drugs. The state of the patient's accommodation and not his age should determine the use of a cycloplegic. The accommodation should be studied as a routine measure in all cases before a cycloplegic is used.

Accurate data as to the effect of a drug on accommodation are obtained by measuring the residual accommodation. This information should govern the dosage.

From this study it would seem that the residual range, after a cycloplegic has been given, should be from 2 to 3 diopters, in order correctly to determine the refractive error, regardless of age. Further reduction seems unnecessary. Duane placed this figure at less than 1 diopter.

W. S. REESE.

Physiologic Optics

THE ASTIGMATISM PRODUCED BY LOOKING OBLIQUELY THROUGH CORRECTING LENSES. BICHELONNE, Arch. d'opht. **48:** 332 (May) 1931.

The author first refers to the paper of Joseph in which he gave the history of the development of periscopic lenses. Tscherring originally worked out the basic calculations for an astigmatic lens. When a bundle of parallel rays of light passes through a lens, it is transformed into a cone-shaped, more or less sharp bundle, the apex of the cone sometimes being blurred. This blur can be neglected when the rays are parallel to the axis of the lens, but the blurring is quite noticeable when an obliquity of 30 degrees is reached, which is about the limit of periscopic vision.

Two tables of curves are presented, which show the amount of astigmatism produced by various types of lenses at different angles of obliquity.

S. B. MARLOW.

Physiology

OPHTHALMOTONIC REACTIONS EXPERIMENTALLY PRODUCED BY THE ORBITAL INJECTION OF VARIOUS SUBSTANCES. L. WEEKERS, Arch. d'opht. **48:** 321 (May) 1931.

Certain clinical observations prompted Weeker to study the question of ophthalmotonic reactions systematically by experiments on animals. The first experiment concerned the observation by Fromaget of the reduction of tension in cases of secondary glaucoma following the retro-ocular injection of procaine hydrochloride and epinephrine. The second concerned the lowering of tension that followed the retro-ocular injection of 40 per cent alcohol into painful eyes. Davis had called attention to this phenomenon before the author. The author used rabbits in his experiments, the tension being recorded by means of the Schiötz tonometer. He grouped the substances used under four headings: (1) hypertonic, isotonic and hypotonic saline solutions, (2) substances with an alkaline or an acid reaction, (3) lymphagogues, irritants or caustics and (4) substance having a more or less specific action, such as epinephrine and histamine. He presents the protocol of an experiment in

which 1 cc. of 20 per cent sodium chloride was injected into the right orbit. This was followed by a sharp rise in tension, which soon fell and remained below normal for several days. A similar but less marked reaction occurred in the opposite eye, into which no injection was made. The same reaction was produced by other salts, such as sodium salicylate and the salts of calcium. When a lower concentration was used, the same reaction occurred, but lasted a shorter time. The same type of reaction was also produced by the injection of substances in the second and third groups. The fourth group the author reserved for special study. With weak doses, an ophthalmotonic reaction sometimes takes place. This reaction almost always consists of a hypotony of small degree and short deviation and increases as the dose is increased.

Weekers believes that these observations open new therapeutic possibilities, whatever the underlying physiologic laws may be. The discussion of these laws he leaves to a future report.

S. B. Marlow.

The Nervous Pathway of Lacrimation. A. Lutz, Arch. f. Ophth. **126:** 304, 1931.

This article represents a thorough review of the literature on the neurology of lacrimation. Several personal observations are quoted, among which the following is of great interest: A woman, aged 48, had pricking pain in the right side of the upper jaw and orbit for eight months and diplopia for three months, and she had lost 35 pounds (15.9 Kg.). The author found anesthesia in the region of the right maxillary nerve, hyperesthesia and paresthesia of the ophthalmic nerve. The right abducens was paralyzed. The patient volunteered the information that for the previous ten months she had not been able to cry with her right eye. The author found that neither psychic nor reflex lacrimation could be elicited. Roentgen examination of the skull revealed a round tumor the size of a hazelnut in the posterior wall of the right maxillary sinus.

The author stresses the point that because of the complicated nervous pathway, disturbances of normal lacrimation are very important signs of lesions of the sphenopalatine fossa, at the base of the skull, of the os petrosum and of the brain stem and its surroundings, which have to be recognized.

P. C. Kronfeld.

Refraction and Accommodation

Orthopedics and Correction of Conical Cornea by Contact Glasses, the "Spectacle of the Future." J. Strebel, Schweiz. med. Wchnschr. **61:** 110 (Jan. 31) 1931.

In a report of six cases the author shows the value of both the Zeiss and the Müller glass as means not only of correcting visual acuity, but also of preventing further progress in the corneal disease. The ease with which a person may become accustomed to the glasses and enthusiasm for their use in many refractive afflictions are shown.

L. L. Mayer.

REFRACTION MYOPIA. E. TRON, Arch. f. Ophth. **126:** 454, 1931.

In a previous article the author published the results of his measurements on fifty-three emmetropic eyes; namely, that the refractive power of the cornea varied from 37.00 to 48.14 diopters, the refractive power of the lens from 20.19 to 34.09 diopters, the total refractive power from 57.47 to 72.10 diopters and the axial length from 20.46 to 25.46 mm.

Consequently, myopia can be of three different types:

1. Axial myopia. The axial length is considerably greater than the upper limit for emmetropic eyes. All the other optical elements lie within the limits for the emmetropic eye.

2. Refraction myopia. The refractive power of the eye is greater than that of the emmetropic eye, while all the other elements lie within normal limits.

3. Combination myopia in which every optical element lies within the limits for the emmetropic eye, but the axial length and refractive power happen to be nearer the upper limits.

In three cases, the author found three eyes that represented the condition of refraction myopia:

Case	Degree of Myopia	Total Refractive Power	Axial Length
1	— 5.00	76.83	20.96
2	— 20.00	78.18	25.14
3	— 20.00	86.56	22.39

The analysis of these three cases showed that the increased total refractive power was the result of increased curvature of the surfaces of the lens. The equatorial diameter of the lenses seemed to be normal. The author proposes the following classification of myopia of the lens:

I. That caused by an increased refractive index (incipient cataract, lens with double focal point).

II. That caused by an increased curvature of the surfaces:

(1) Lenticonus anterior or posterior.
(2) Luxation or subluxation.
(3) Microphakia or globophakia.

P. C. KRONFELD.

Retina and Optic Nerve

THREE CASES OF RETINITIS WITH WHITE SPOTS; SUCCESSFUL TREATMENT WITH A-O VACCINE. THE INCIDENCE OF TUBERCULOUS RETINITIS AMONG THE JAPANESE. Y. SHOJI, Arch. d'opht. **48:** 241 (April) 1931.

The author first describes three cases of retinitis characterized by loss of vision and the occurrence of white spots or whitish exudate in the retina, hyperemia of the disk and dilatation of the veins with hemorrhages but without changes in the vitreous or anterior segment. The three patients were all young and showed negative Wassermann reac-

tions. Two had positive Pirquet tuberculin reactions. The differential diagnosis between (1) exudative retinitis (Coat's disease), (2) pseudoalbuminuric retinitis and (3) tuberculous retinitis is discussed. The three cases recorded in no way resemble the cases of tubercular lesions more commonly seen. The cases reported by O'Sullivan and Story, Jackson, Leber, Knapp and Bartels are similar and were favorably affected by tuberculin.

In Japan, Komoto and Onishi have reported similar cases. Yamanaha has reported three cases of tuberculous exudative retinitis, Suzuhi a case of primary tuberculosis of the retina, Hayashi three cases of tuberculosis of the retina and Takagi a case of detachment of the retina in tubercular retinitis.

The two cases reported by Knapp most closely resembled those of the author, especially in regard to the favorable action of tuberculin and A-O vaccine. A-O vaccine is a polyvalent vaccine, nonpathogenic and easily absorbed, composed of the protoplasm of the growing bacillus. It was devised by Arima-Aoyama-Ohnawa and has proved beneficial in the treatment of patients with many different tuberculous conditions.

S. B. MARLOW.

THE TREATMENT FOR DETACHMENT OF THE RETINA BY THE OBLITERATING THERMOPUNCTURE OF GONIN. VEIL and DOLLFUS, Arch d'opht. **48:** 403 (June) 1931.

The experience gained by seventeen operations in eleven cases of detachment leads the authors to believe that this operation is well tolerated and can be repeated on the same eye several times without causing any damage. They point out that tears of the retina have been known to exist in cases of detachment for a long time. De Wecker described them in 1887, and Leber had noted their frequency in 1882, tears being found by the latter author in eleven of fifteen recent detachments and in three of twelve old cases. They refer to the statistics of Nordenson, who found the majority of the tears in the thirty-five of the forty-six cases examined to be situated in the superior temporal region. Gonin's observations are in agreement. Besides the eleven cases reported, the authors have seen six other cases in which operation was refused. They found tears in thirteen of a total of seventeen. They describe in detail the technic to be followed in searching for tears and emphasize the importance of complete dilatation of the pupil. Change of posture and the question of removing the subretinal fluid are also discussed. The authors followed the Gonin's method for localizing the tears. They are of the opinion that the location is more commonly calculated too far forward than otherwise. After operation the patient remains in bed for from eight to ten days, his head immobilized in such a position that the retina falls into place. The dressing is changed at the end of forty-eight hours and atropine instilled. Some congestion is generally present, but on only one occasion was this marked and associated with vitreous disturbance. Ophthalmoscopic examination is made on the fourth or fifth day. The sutures are removed on the eighth, and the patient allowed up on the ninth or tenth. They believe it useless to keep the patient recumbent longer because if the retina is not reattached it will become separated as soon as the patient gets up no matter

how long he has been kept flat. After the patient has gotten up, a careful examination is made to see whether the tear has been closed or not. If only partially closed, nothing is done, for the process of cicatrization may completely close it. If the tear has not been touched, a second operation is done at the end of about fifteen days. In one of the author's cases the tear was not closed until after the third intervention. Reoperation is done when the first is incomplete, when the tear is too large or when more than one tear is present. The authors are firmly convinced that the tears must be obliterated if reattachment is to result. The detailed records of their cases are presented.

S. B. MARLOW.

OPTIC ATROPHY DUE TO THORACIC COMPRESSION. J. ROLLET, Arch. d'opht. **48:** 434 (June) 1931.

The recognition of ocular accidents due to trauma to the chest dates only from the beginning of the present century, although medical lawyers had begun to study the mechanism of death in cases of this kind about the middle of the last century and were soon followed by surgeons, who described the many clinical aspects. The author states that only ten cases were collected from the literature by Picard and Dreyfus in 1928. To these he adds that of Bollack, Bontemps and Bourgeois and that of Velter. He also reports a personal observation. The mechanism of the production of the ocular lesions is still under discussion. The hemorrhages and exudates sometimes present can easily be explained on the basis of interference with the venous circulation, but the optic atrophy cannot be explained so readily. Hemorrhage into the optic nerve sheath or the nerve proper is the general opinion. On the other hand, it is possible that tensional changes occur and produce direct injury to the retina itself. The ganglion cells may be injured not only by pressure, but also by the momentary stasis that takes place, thus producing toxic injury to them. The optic atrophy is then consecutive. This same kind of explanation has been proposed by Terrien to account for the atrophy that follows considerable loss of blood. The author suggests the possibility of some anatomic variation in the venous system of the head and neck which predisposes to ocular complications. Up to the present, no conclusions are possible in this respect.

S. B. MARLOW.

SOLITARY RETINAL ARTERIAL HYPERTENSION OF VASCULAR ORIGIN. C. ESPILDORA LUQUE, Arch. de oftal. hispano-am. **31:** 487 (Sept.) 1931.

This article supplements a former one by the same author on "Retinal Arterial Hypertension." The author first calls attention to the anatomic conditions of the cerebral circulation and its peculiar sympathetic innervation, which favors certain conditions surrounding it. It is not consequently surprising that observation of the retinal arterial pressure, as an exponent of the blood pressure of the carotid territory, has confirmed this autonomy foreseen by anatomists and physiologists. The author has had occasion to corroborate the existence of a high retinal blood pressure in patients with normal brachial arterial tension.

The existence of an independent high retinal arterial pressure has been previously observed by Bailliart, Bollak and others in cases of increased intracranial pressure without papilledema. An independent high retinal blood pressure has also been determined in certain local ocular conditions, such as glaucoma and rhinogenous retrobulbar neuritis, due to direct or reflex influence. The author, however, has found high retinal arterial hypertension in cases in which neither the intracranial nor the local causes produced by vascular lesions or disturbances of vascular innervation in the territory of the carotid artery existed.

In his previous paper, the author called attention to a disproportionately high retinal arterial tension in some cases of high general blood pressure. The symptomatology of the new group of cases is practically identical with that of the former group, with the sole difference of a normal brachial arterial tension.

In these cases local vascular lesions may be found favored by local disturbances of innervation produced by endocrine, toxic or infectious influences and by the mechanical action of an intracranial hypertension.

The symptoms observed in these cases are: headache, nocturnal in character with an occipital localization, tinnitus, vertigo, amnesia, sensations of tingling, paresis and ocular symptoms, consisting of smoky vision, muscae volitantes, phosphene and temporary blindness.

These symptoms, which are similar to those in cases of increased intracranial pressure, can be distinguished from them by the lesser intensity and the absence of vomiting by the fact that the increase in the retinal pressure is diastolic in cases of increased intracranial pressure and systolic in those of pure vascular retinal hypertension.

The author reports twenty cases in detail, pointing out in each case the individual differences in the objective and subjective symptoms.

C. E. FINLAY.

SOLITARY RETINAL HYPERTENSION OF MENINGO-ENCEPHALITIC ORIGIN. C. ESPILDORA, Arch. de oftal. hispano-am. **31: 537** (Oct.) 1931.

While recognizing the diagnostic importance of papilledema in cases of intracranial hypertension, the author refers to the frequent occurrence of cerebral tumors with normal ocular fundi. In these cases Bailliart's ophthalmodynamometer reveals circulatory disturbances not discernible by simple ophthalmoscopic examination, which permits the determination of intracranial hypertension when no papilledema is present. The data furnished, in this respect, by the ophthalmodynamometer are more reliable than those furnished by lumbar puncture, which may give negative findings in cases in which there is blocking at the occipital foramen.

As soon as the intracranial pressure is increased, either on account of some meningeal process or from the presence of an intracranial tumor, the intracranial circulation is affected. This disturbance first affects the venous circulation, producing an increase of resistance which can be overcome only by an increase of arterial pressure, the simultaneous ischemia of the nerve centers tending to a similar result, with a corresponding increase of the retinal diastolic pressure in cases in

which papilledema does not exist. This fact has been confirmed by Kalt, Claude, Lamarche, Dubar, Berens, Smith and Cornwell. The condition exists whenever the retinal diastolic pressure exceeds half of the brachial pressure by from 10 to 15 mm. The retinal hypertension precedes the occurrence of papilledema and diminishes when the intracranial pressure is reduced by lumbar puncture or by hypodermic medication. The hypertension, as a rule, disappears as soon as papilledema is established, although this occurrence is not constant, as Kalt, Colrat and the author have observed.

The differential diagnosis between increased retinal hypertension due to increased intracranial pressure from that produced by vascular processes, which presents similar symptoms, is based principally on a simultaneous increase of the systolic pressure in the latter case. There is also some difference in the subjective symptoms: The headache is more violent, more constant and more persistent and produces more disability in cases of intracranial hypertension than in the vascular variety. The visual disturbances, on the other hand, are more pronounced in the vascular variety. In the intracranial variety disturbances do not appear until papilledema is established; one also finds a high tibial arterial pressure in cases in which the brachial pressure is normal. Epistaxis, subconjunctival hemorrhages and minute retinal hemorrhages are more usually found in the vascular variety.

The author finally reports several cases in detail, with comments on the interesting and distinctive features of each. C. E. FINLAY.

PATHOGENESIS AND THERAPY OF DETACHMENT OF THE RETINA. WESSELY, Klin. Monatsbl. f. Augenh. **86:** 247 (Feb.) 1931.

Wessely stated that there still remain objections to the theory that detachment of the retina is caused by traction from within. None of the modern explanations makes it clear why a large quantity of vitreous fluid should be forced through a rent in the retina in a manner that produces hemispheric bags, nor why these detachments frequently sink to the lower portion of the fundus. By a large number of specimens the author shows that retractive processes from the front, as well as transudative processes from behind the retina, are instrumental. Ruptures in retinal detachment may be missing or may develop secondarily.

Wessely discusses the question whether ignipuncture actually causes a caustic closure of the rent in the retina, and whether the closure of the tear itself is really a decisive element in obtaining a cure. Agglutination of the retina with its substratum is to him a more important aim in the operation than the closure of the rupture. Occasionally, good results have been obtained in cases in which the rupture was neither found nor closed.

Twenty-one ignipunctures were done by Wessely in eighteen patients. He distinguishes between "improvements" and "anatomically complete healings." He sees an improvement when even a small portion of the retina remains detached, irrespective of a visual improvement. Anatomically healed detachments are those in which no trace of the detachment can be discovered during a long period of observation with the ophthalmoscope. Four good results in the first group and three in the

second were obtained in the fifteen patients treated with a single ignipuncture. The eleven failures were unfavorable from the beginning, owing to the long duration of the detachment or to the largeness of the tears or to their traumatic origin. A second ignipuncture in three of these cases produced no good results. In four other cases of comparatively recent myopic detachment, an initial success was frustrated by the recurrence of the detachment to its original extent or totally. Frank publication of all results will be necessary to the forming of a reliable basis for this operation. The problem of the pathogenesis of detachment of the retina and of the therapy in this condition has not been solved.

K. L. STOLL.

CONE-SHAPED DISKS AND HYALOID DRUSES. W. LOEHLEIN, Klin. Monatsbl. f. Augenh. **86:** 433 (April) 1931.

The author reports on five cases in which the disks had acquired a conical shape through the formation of hyaloid druses. The druses were chiefly of a spherical shape. The prominence of the disks, amounting to more than 2 diopters in each case, might have been confused, at first glance, with choked disk or papilledema. These cases differed from most cases of druses reported on account of the large, homogeneous, grayish-pink masses unevenly distributed between the meshes of the lamina cribrosa. Their bulk had raised the papillary portion of the central retinal vessels. The appearance of all of these five patients was nearly the same in both eyes. Pigmentation of the disks was absent, while the pigment layer of the retina was very opaque, hiding details of the choroid. Evidence of previous disorders could not be found in these ten eyes; their function was normal, with one exception, in which an old peripheral patch of tubercular choroiditis existed. Healed tuberculosis in this case was the only general pathologic change found in these five persons. All the patients, except a man aged 52, were less than 20 years of age; senile degeneration, therefore, can be ruled out. The author is rather inclined to believe that the process began in childhood, considering its well known slow progress. A plate with four colored pictures is appended.

K. L. STOLL.

DETACHMENT OF THE RETINA FOLLOWING ACCIDENTS. ZUR NEDDEN, Klin. Monatsbl. f. Augenh. **86:** 496 (April) 1931.

It is doubtful whether indirect lesions of the eye after concussion of the head, or after overexertion, cause detachment of the retina. Eyes with myopia or senile changes, however, are predisposed to suffer a detachment after accidents, although it may occur spontaneously, subsequent to processes of chronic degeneration.

The importance of a tear in the retina is overestimated. It is not the cause of the detachment but a more or less irregular symptom, therefore absent in some cases of spontaneous detachment. The detachment itself is the symptom of a complicated process, involving the retina, choroid and vitreous. Constantly progressing, it winds up with cataract and iridocyclitis without any evident cause. The observation that the detachment begins in the upper portion of the retina and progresses downward is in itself an argument against the claim that the rupture is the cause of

the detachment. It is not plausible that, after spontaneous closure of the tear in the upper retinal region, another tear should occur in the lower portion of the retina.

The explanations of the mechanism in Gonin's ignipuncture are incorrect, in the author's opinion. Burning will never close a tear, but rather enlarge it. Nor can adhesions, produced by ignipuncture, prevent further escape of vitreous. This seems so much more impossible as the burnt area does not involve the retina. A glowing platinum wire will cool off the moment it is dipped into water or any fluid contained in the eye. Results here are not obtained by caustic action, but by thermic irritation which improves the disturbed intra-ocular nutrition, as pointed out by Wessely (*Klin. Monatsbl. f. Augenh.* **86: 247** [Feb.] 1931). Ignipuncture is superior to other therapy, because it places the desired irritation into the globe itself.

No theories on the mechanism of the detachments of the retina can be satisfactory when they dwell on isolated symptoms rather than on the general aspect of this disorder. Hence we have the various evaluations of the therapeutic effects. Clinical experience only should be considered to determine connections between detachment and accident. This connection exists only in severe contusions which were accompanied by unconsciousness as well as distinct signs of an external lesion. Such a relation between detachment and accident exists in myopic persons who overstrain themselves in an extraordinary manner, especially in stooping positions. The author reports four cases of high myopia in which severe contusions did not lead to detachment. These and eight cases of less severe contusions are reported as proof for the fact that detachment need not occur, even in old persons who are predisposed to the same by their myopia. Detachment of the retina is caused by accident only if it occurs immediately after or within a few days of the accident. Zur Nedden is convinced that very few cases show causative connection between indirect injury and detachment of the retina.

K. L. Stoll.

Exudative Retinitis with Changes in the Blood Vessels. P. Junius, Klin. Monatsbl. f. Augenh. **86: 577** (May) 1931.

A case of exudative retinitis without changes in the blood vessels was reported recently by Kalt. It offered some symptoms similar to those found in two of the author's cases which, however, showed distinct vascular changes.

A physician, aged 42, who had never been sick, except with diphtheria at the age of 34, suddenly had headaches and pain in one eye, with resulting impairment of the vision. At that time fine capillary hemorrhages were found in the fundus and four grayish-white infiltrations in the area of the temporal inferior central retinal vein. Larger exudations developed later as well as changes of the temporal inferior artery, of the temporal superior artery and finally of the temporal inferior vein. Three months after the onset the patient felt well, and the vision was normal; a minor contraction of the field of vision caused no disturbance. The interior temporal artery, however, had not regained its normal condition three years later. Junius, rejecting "retinitis circi-

nata" and "central disciform retinitis," which were the original diagnoses made in this case, chose the term "exudative retinitis with changes of the blood-vessels."

Another, similar case, reported as case 119 in the monograph of Junius and Kuhnt, is described as disciform central restinitis, bordering on retinitis circinata. It was very severe and unfavorable, and presented active pathologic involvement of the inferior temporal artery twenty-three years after the onset of the disease.

Discussing the question whether the exudates in the retina or the changes in the blood vessels come first, the author, in agreement with Morax, believes the vascular changes are primary. This view, in the author's opinion, is sustained by some theories of earlier pathologists and by recent physiologic research, e. g., on the hormones which may act as poisons for the capillaries.

K. L. STOLL.

AXIAL OPTIC NEURITIS. C. OGUCHI, Acta Jap. Ophth. Soc., July, 1930, p. 125.

The author believes that the terms retrobulbar neuritis and axial neuritis are frequently confused. In retrobulbar neuritis there may be inflammatory changes at the disk. In axial neuritis other fibers besides the papillomacular bundle may be involved, especially in acute axial neuritis (Wilbrand-Sanger). The following causes of axial neuritis are usually given: (1) poisoning, beriberi, diabetes, pregnancy and lactation; (2) diseases of the hypophysis, Leber's disease, tumors of the frontal lobe and nutritional disturbances; (3) multiple sclerosis; (4) nasal sinus disease, and (5) syphilis, tuberculosis and other infectious diseases.

Multiple sclerosis is rarely found in Japan. Chronic amblyopia due to alcohol and tobacco is also rare. In lead and carbon sulphide poisoning, papillitis is more apt to be present, so it is not correct to call this a retrobulbar neuritis. Horniker found macular changes in tobacco amblyopia. It is difficult to answer the question whether the visual disturbances in beriberi are a direct result or are due to a lack of vitamin B. Certain authors have found clouding and hyperemia of the disk, and, with the red-free light, a dulness between the disk and the macula as well as macular changes. Therefore, this condition cannot be regarded as a simple retrobulbar neuritis. In nasal sinus disease one finds two types of optic nerve trouble. One is the acute retrobulbar neuritis in which the vision at the beginning is much reduced and then a central scotoma develops. There is edema of the papilla which justifies the French term of edematous neuritis. True axial neuritis is probably very unusual. There have been very few pathologic investigations. In one of Herzog's cases perineuritis and peripheric interstitial neuritis were present. Why the fibers lying centrally in the optic nerve canal are principally affected is difficult to explain. In one case of Harada's there were changes at the papilla and in the intervening retina, so that a central retinitis must have been superimposed.

Pure axial neuritis is unusual, and is frequently associated with changes in the eyegrounds. A toxin can affect the nerve fibers just as well as the macular region; hence central retinitis is frequently found with a retrobulbar neuritis. It would be well to call this axial neuro-

retinitis. Vitamin deficiencies are an important cause of axial neuritis. In addition to lack of vitamins A and B there are many other deficiencies that might explain obscure lesions of the retina and optic nerve. Inatomi has found an axial neuritis that occurred in epidemics with superficial keratitis, apparently caused by a deficiency of vitamin A. The author has already stated that the cornea requires much vitamin. According to the quality and the quantity of the poison, different lesions are caused. The cause of central retinitis varies greatly. It may occur in the early stage of a nephritic retinitis or of a diabetic retinitis. It appears in cases of vitamin deficiency. The living conditions of the Japanese as compared with Europeans are of moment particularly as regards the kind and preparation of food.

A. KNAPP.

Trachoma

COMPARATIVE STUDY OF SOME SOURCES OF BACTERIUM GRANULOSIS. MORAX and NIDA, Rev. internat. du trachome **8:** 136 (July) 1931.

The authors investigated the reactions of Bacterium granulosis isolated by Noguchi, Olitski and Lumbroso of Tunis. The Lumbroso organisms showed a canary yellow growth on mediums, while the other two were grayish. The other comparisons were inoculations into chimpanzees, action on the carbohydrates, agglutination and deviation of the complement. They conclude that the general reactions of these three organisms are of the same general nature; however, the serum of rabbits treated with the antigen of the Olitski organism gave a positive reaction with the antigens of both the Noguchi and the Olitski organisms, but negative reactions with the antigen of the organism of Lumbroso.

L. L. MAYER.

THE OPERATIONS OF CHOICE IN TRICHIASIS. B. ADAMANTIADIS, Rev. internat. du trachome **8:** 140 (July) 1931.

In an article appearing in the September, 1928, issue of the *Revue internationale du trachome,* MacCallan and Peretz indicated that in trichiasis the three operations to be used are as follows: (1) the combined excision of the tarsoconjunctiva, (2) the wedge excision and (3) the mucous graft.

The author agrees to the latter two, but adds the operation of Panas as his first choice.

The indications for each are as follows:

1. The operation of Panas is used only when the tarsus does not present a considerable thickening. The trichiasis is localized on the free border in these cases. A tarsal excision is therefore useless and injurious. Simple incision is sufficient.

2. The wedge excision or partial tarsectomy, known as Snellen's operation, is used when the tarsus is deformed.

3. The mucous graft of van Millingen is used in those cases of relapsing trichiasis in which the tarsus is already scanty and a new or like excision may cause lagophthalmos.

The technic of each operative method is outlined. In the last few years the author has operated in 537 cases, 142 with the Panas technic, 360 by partial tarsectomy and 35 by the mucous transplant. Relapses occurred in from 5 to 6 per cent. L. L. MAYER.

Tumors

HEMANGIOMA OF THE CILIARY BODY. R. K. DAILY, Am. J. Ophth. **14:** 653 (July) 1931.

An infant of 5 months suffered severe pain apparently from an inflamed right eye. The mother stated that the child had had recurrent hemorrhages into the anterior chamber. The tuberculin and Wassermann reactions were negative. When first seen, the tension was high, and the anterior chamber was filled with blood. When this blood absorbed, a very narrow, dark brown growth could be seen in the angle of the anterior chamber, nasally. The eye was enucleated, and a dense neoplasm was found in the ciliary body, 7 mm. long, the width of the ciliary body, and 1.5 mm. thick. It produced an iridodialysis, and a portion projected into the anterior chamber at the filtration angle. Microscopic examination showed numerous capillary vessels between which were cords of rather large cells with vesicular nuclei. The diagnosis was capillary hemangioma of the ciliary body.

W. S. REESE.

FIBROMA UNDERGOING MALIGNANT CHANGES. Fourth Ann. Rep. Giza Mem. Ophth. Laboratory, 1929, p. 33.

The patient was a man, 28 years of age. Since childhood he had had a small soft tumor of the right eyebrow adherent to the skin. Three years ago a small growth had appeared in the region of the right upper lid and had attained the size of a hen's egg. The eye could not be opened because of the tumor. The growths were enucleated. Six months later there was a recurrence at the site of the former growth on the lid, invading the surrounding tissues. Both tumors were encapsulated. Sections showed numerous fibroblasts and a varying amount of intercellular substance. In places there was hyaline myxomatous degeneration. The recurrent growth was definitely sarcomatous. The cells were of the spindle type and showed active mitosis. Blood vessels were not numerous. Small hemorrhages were present. W. ZENTMAYER.

MYELOMA OF THE ORBIT. Fourth Ann. Rep. Giza Mem. Ophth. Laboratory, 1929, p. 42.

The patient was a girl, aged 8 years. Proptosis of the left eye had begun two months previously and was extreme. A tumor of firm consistence could be felt in the roof of the orbit. Later the cornea sloughed. The orbit was exenterated. Three months later it was filled with a recurrent growth, and there was a large swelling of bony consistence in the region of the maxillary antrum. There was no adenopathy.

On the grounds of the morphology of the cells, the tumor was probably a myeloma. It was not of the plasma cell type, but myeloblasts, myelocytes and erythroblasts, all embryonal, were present. There was some doubt that the tumor was primary.

W. ZENTMAYER.

PRIMARY SARCOMA OF THE CARUNCLE AND SEMILUNAR FOLD. ALEXIADÈS, Arch. d'opht. **48:** 341 (May) 1931.

The author points out that tumors of the caruncle and semilunar fold are infrequent. The majority of new growths in the caruncle are of epithelial origin. He refers to some of the cases that have been reported in the literature. The tumors arising from the semilunar fold are more often sarcoma. He reports the case of a 7 year old boy who presented a large reddish mass in the inner canthal region. This was completely removed surgically, and no recurrence was noted after more than a year's observation. Histologic examination showed it to be a round cell sarcoma. Anatomic and histologic study showed no evidence of the presence of either caruncular tissue or of the semilunar fold. The author suggests that the tumor probably arose from the semilunar fold and invaded and destroyed the caruncle.

S. B. MARLOW.

MYXOMA OF THE ORBIT. J. BISTIS, Arch. d'opht. **48:** 440 (June) 1931.

The author describes a case of pure myxoma of the orbit which developed in the superior portion, extended to the optic nerve and produced atrophy by pressure. His patient was 29 years of age. He is unable to believe that it arose from the optic nerve itself, as there was no exophthalmos. Pure myxoma of the orbit is very rare. In the literature available to him, he was able to find only the one case reported by E. Fuchs. Similar orbital tumors are usually myxofibromas or myxosarcomas. Tumors containing myxomatous elements often arise from the optic nerve sheaths. Myxomas are usually benign tumors, and sometimes attain considerable size. They can recur and develop into myxosarcomas.

S. B. MARLOW.

PLASMOCYTOMA OF THE CONJUNCTIVA. E. RAVEIDINO, Ann. di ottal. **38:** 545 (Oct.) 1931.

The patient, a boy of 19, showed a raised mass occupying the outer two thirds of one upper lid. Sections showed it to consist chiefly of plasma cells with a scanty connective tissue stroma. The cells showed wheel-like arrangement of chromatin in the nuclei and cytoplasm which took the basophil stains. The author believes that the condition is a form of neoplasm due to proliferation of plasma cells.

S. R. GIFFORD.

METASTATIC SARCOMA OF THE CILIARY BODY. A. CORRADO, Arch. di ottal. **38:** 508 (Sept.); 523 (Oct.) 1931.

The author reviews fourteen cases of metastatic sarcoma of the uveal tract previously reported. His patient was a man of 26, in whom, six years before, a pigmented tumor had developed on the right calf,

which slowly increased in size for four years. Following an injury to the tumor, it began to grow rapidly and became painful and ulcerated. It was removed with some enlarged inguinal glands, but recurred after seven months. Pigmented nodules appeared in the subcutaneous tissue elsewhere, and an empyema developed. A loss of the visual field was noted, and ocular examination revealed an oval black mass in the angle of the left anterior chamber. Vision was reduced to counting fingers owing to lens opacities, and the tension was reduced. The eye was enucleated because of pain. Six weeks later the right eye showed a similar black nodule in the chamber angle which grew rapidly, until in three months vision was reduced to counting fingers. A nodule was also present in the upper tarsus. Sections showed the mass to have originated in the ciliary body involving part of the choroid posteriorly and the iris root anteriorly. It was composed of spindle cells containing pigment and was considered a melanotic sarcoma. Of the fourteen cases of metastatic sarcoma previously reported, in only four did the tumor originate in the iris or ciliary body. In all four cases the original tumor was in the skin. In only one previous case, that of Cordes and Horner, were both irides involved. A bibliography is given.

S. R. GIFFORD.

Uvea

A CASE OF HETEROCHROMIA IRIDIS. V. L. RAIA, Am. J. Ophth. **14:** 299 (April) 1931.

A man, aged 29, developed left mastoiditis, which was operated on, following which he saw black spots in front of his right eye. About two years later, he noticed the color of his iris had changed. The author followed this change until the entire iris had become gray. Four years after the initial attack, the left mastoid again required operation, and a month later the left iris began to change color; this continued until now only a very narrow zone of faint brown tint remains around the pupillary margin.

The author concludes that the heterochromia is the result of focal infection.

W. S. REESE.

UVEITIS ASSOCIATED WITH ALOPECIA, POLIOSIS, VITILIGO AND DEAFNESS. W. R. PARKER, Am. J. Ophth. **14:** 577 (July) 1931.

A youth, aged 18, gave a history of pain in the eyes and progressive loss of vision for ten days. He attributed it to the ingestion of homemade liquor to which had been added caustic potash. Both eyes exhibited uveitis and neuroretinitis. In spite of very thorough physical, local and systemic treatment and removal of all foci of infection, the uveitis progressed. Ten weeks after the onset of the disease the proximal ends of the eyelashes were gray, and during the next week a patchy alopecia developed. Four months later, the eyes were quiet but the pupils were filled with exudate and vision in the right eye was limited to counting fingers and in the left, to moving objects. The lashes and eyebrows were white, and there were several round areas of alopecia. An early vitiligo was present on the face, neck and shoulders.

The second case was that of a woman, aged 25, who was examined because of blindness of ten months' duration. This began as a severe cold, vision failed rapidly, and one month after the onset she suffered attacks of vertigo, ringing in the ears and a distinct but not severe deafness which persisted for about four weeks. Three months after the onset of the disease, the hair of the head and the lashes and eyebrows began to fall out. She lost weight, felt restless, and at times experienced extreme fatigue. The hair began to grow, coming in almost white, a striking contrast as the hair was originally black. Twelve months after the onset her friend noticed that her eyebrows were returning to their original color. Sixteen months after onset of the disease the vision in both eyes was perception of light. General examination gave negative results.

The author discusses the reported cases (sixteen), and speaks of the resemblance to sympathetic ophthalmia. He gives a table showing the frequency of the different symptoms and discusses the etiology.

W. S. REESE.

IS THERE AN ISOLATED SYMPATHETIC CHORIORETINITIS? B. FLEISCHER, Klin. Monatsbl. f. Augenh. **86:** 183 (Feb.) 1931.

The author observed a peripheral chorioretinitis in the left eye of a patient whose right eye had been injured by a piece of steel in 1909. The results of examination with the roentgen rays, the sideroscope and the magnet were negative at that time. Reexamination of the right eye in November, 1930, furnished a positive reaction on the siedroscope, and a pigmented area with surrounding atrophy of the choroid was seen near the disk, where the presence of the splinter was demonstrated by a roentgenogram. The disk had a normal color; discoloration of the iris was not mentioned; chronic recurrences of iridocyclitis of a mild type were recorded. The left eye was free from inflammation; the media were clear, and the disk was normal. Chorioretinal changes of a peculiar appearance were found in the periphery of the fundus. They resembled the "salt-and-pepper retinitis," but the spots were more distinctly defined and round, and the pigmentation was of a less granular form. These foci were similar to those occasionally seen in sympathetic iridocyclitis. As Fleischer could not detect any other causes, he considered this a probable sympathetic disease. His view seemed to be corroborated by the recurring iridocyclitis in the injured eye. The relative mildness of the iridocyclitis in the injured eye would explain why the anterior portion of the left eye was not involved.

K. L. STOLL.

Visual Tracts and Fields

LEFT HOMONYMOUS HEMIANOPIA FROM CALCIFICATION OF THE INTERNAL CAROTID ARTERY. V. PETRAGNANI, Riv. oto-neuro-oftal. **8:** 317 (July-Aug.) 1931.

Homonymous hemianopia is of relatively frequent occurrence. In its multiple etiology, vascular changes at the cranial base should be considered just as frequently. These changes occurring in the anterior cerebral arteries or in the internal carotids (syphilitic lesions, veritable

atheromatoses) are in the nature of an infiltration of their walls (media and intima) with calcium and magnesium. When these alterations are localized primarily in the internal carotids, in the region of the sella turcica, the pressure exerted on the chiasm results in a compression hemianopia, first described by Morelli in the "Valsalva" of 1925. This mineral infiltration of the carotid wall impairs its vitality and leads to aneurysmal distention (Reverdino, 1928).

Only a stereoscopic roentgenogram will better differentiate the pathognomonic sign of a dense calcium shadow from extraneous shadows or opacities.

The author presents just such a comparable case in a patient 77 years old, having a clearly defined arteriosclerotic symptomatology, increased arterial pressure, left homonymous hemianopia and a calcareous opacity in the right parasellar zone. Other possible etiologic factors are excluded.

The author presents proof that this lesion is very slowly progressive. At times, the scanty residual function is preserved for a long period of years.

He points out also that blood vessels in the head are not immune to calcification even in youth, and that this may take place in the smaller vessels and capillaries.

V. R. SYRACUSE.

Society Transactions

EDITED BY DR. JOHN HERBERT WAITE

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY, AND AMERICAN COLLEGE OF SURGEONS

ALGERNON B. REESE, M.D., *Secretary*

Joint Meeting, Oct. 14, 1931

MARK J. SCHOENBERG, M.D., *Chairman*

SYMPOSIUM ON INDUSTRIAL INJURIES OF THE EYE AND ORBIT

INTRA-OCULAR FOREIGN BODIES. DR. EDWARD B. HECKEL, Pittsburgh.

A foreign body in an eye means potentially a lost eye, and is therefore a condition so serious that it warrants all possible skilful technic and careful asepsis. When patients with suspected intra-ocular foreign bodies are seen, a careful inquiry is made into the modus operandi of the accident, the character of the tools, etc. A thorough ocular examination is made, after which tetanus antitoxin is given, and a roentgenogram is ordered for diagnosis and localization. A wound of the eyeball should never be probed, nor should a magnet be used as a diagnostic instrument. If the roentgen localization does not correspond in position to the history of the case, a second roentgenogram is ordered to be taken, preferably by another roentgenologist. The large magnet is not used, but always a hand magnet of the speaker's own construction. It is only 7¾ inches (19.65 cm.) long, weighs 6½ pounds (2.9 Kg.), and has a solid, removable core. The latter has the advantage over magnets onto which small tips are screwed, in that it gives a large saturated field, which for purposes of extracting foreign bodies is more important than lifting power. When small tips are applied to magnets, there is never complete magnetic union, no matter how perfectly the tips fit.

Dr. Heckel then cited many cases, giving the history, localization, mode of removal and results.

OCULAR INJURIES: THEIR TREATMENT. DR. GEORGE H. CROSS, Chester, Pa.

This article appears in full in this issue of the ARCHIVES, p. 357.

PROGNOSIS OF CERTAIN EYE INJURIES. DR. E. S. SHERMAN, Newark, N. J.

This article appears in full in this issue of the ARCHIVES, p. 361.

FOREIGN BODIES IN THE EYEBALL. DR. HENRY S. MILES, Bridgeport, Conn.

This report is based on seventy-eight cases of intra-ocular foreign bodies, the majority of which were steel and were received through hammering. Thirty-two foreign bodies rested in the vitreous, eighteen in the lens, fourteen anterior to the lens, five in the retina, and three in the sclera, and six passed completely through the globe into the orbit. When the foreign body was in the lens, or anterior to it, a hand magnet was first used, and in eight cases this was successful. In one case in which a small foreign body lodged in the lens, it could not be removed with either the hand or the giant magnet. After two years roentgenograms were made, which were negative. Roentgenograms are usually necessary for diagnosis and localization, but negative reports have been given in five instances when steel was subsequently removed. Foreign bodies that measure 3 mm. or less and are located in the vitreous or the posterior coats of the eye are extracted in the long axis by bringing them around the lens and through the pupil. Larger pieces are liable to become entangled in the iris and are therefore extracted through an incision in the sclera. When this route of delivery is used, complications are more common, and the prognosis is much poorer. It is suggested that, in an effort to prevent detachment of the retina, the scleral incision should be cauterized. The final results of the foreign body extractions were as follows: Twenty-four patients had no sight, but the eyes remained quiet; seventeen had no final vision recorded; nine had vision of some use, and twenty-three had vision from 20/40 to 20/15. Several patients with traumatic cataract could have had the vision improved with an operation.

DEMONSTRATION OF MICROSCOPIC PREPARATIONS OF EYES CONTAINING FOREIGN BODIES. DR. BERNARD SAMUELS, New York.

Fewer intra-ocular foreign bodies are encountered today than formerly, owing to the use of the electric drill instead of the hammer, and to the precautions that are taken in the way of goggles. According to Dr. George Sloan Dixon, of the New York Eye and Ear Infirmary, twenty-five years ago it was no uncommon occurrence in that institution for five or six x-ray pictures of foreign bodies to be taken in an afternoon. However, in 1930, there were but thirty cases of foreign bodies of the globe removed at the infirmary out of a total of more than thirty thousand patients. A fragment of the size of the point of a cambric needle, according to Dr. Dixon, will cast a shadow and may be accurately located.

It is said that foreign bodies enter the globe by way of the cornea two hundred times more frequently than by way of the sclera, because the cornea has a greater curvature and is more exposed than the sclera. The more dangerous route is through the sclera, causing almost invariably intra-ocular hemorrhage from damage to the uveal vessels. Intra-ocular foreign bodies are mostly minute, with sharp edges. The smaller they are the less likely they are to introduce bacteria into the globe. Should bacteria be introduced, the eye is lost, not from the presence of the foreign body, but from infection.

Of all the intra-ocular foreign bodies, iron and copper concern us the most—iron because of its frequency and copper because of its bad prognosis. The latter, although it may be introduced sterile, generally has a most deleterious effect. Its salts may be so irritating to the tissues as to set up an actual purulent inflammation resulting in panophthalmitis and destruction of the globe. On the other hand, the action of the fluids of the eye on iron produces salts that cause a slow degeneration of those intra-ocular structures that are of epithelial origin, especially the retina. The macular region, according to the preparations, is particularly apt to be affected by the impregnation of iron.

It is seldom that a foreign body lodges in the middle layers of the fibrous tunic of the eye. If it is not arrested by the anterior surface, it is apt to traverse the entire thickness. Generally, the force is not spent until the particle has attained the vitreous cavity. This explains why foreign bodies are not often seen in the anterior chamber.

It is characteristic of foreign bodies, of whatever size or description, to form a bed of connective tissue in which to lie. This is true no matter where the location of the foreign body may be. Thus, a particle lying on the posterior surface of the cornea, far removed from any vascular tissue, nevertheless becomes encapsulated. The capsule or bed consists of granulation tissue immediately around the substance, enclosed by dense connective tissue. The size of the bed varies, according to the size of the foreign body and the irritation produced by it. Thus the bed may occupy half the anterior chamber or half the vitreous cavity.

Foreign bodies may be sent with such force that they penetrate the fibrous tunic twice, coming to rest in the orbit. Most eyes suffering from double penetration are greatly damaged, or lost, on account of the bleeding that ensues from the uveal tract; the broken blood vessels pour blood into the vitreous from two points, that of entrance and that of exit.

In large perforations, and it has happened in small ones, cilia may be dragged into the eye and left there after the instrument is withdrawn. It is surprising to what depth, even at the optic nerve, cilia may be found. Wherever located, whether or not free in the anterior chamber, they are irritating and are sure to set up inflammatory reaction in time.

A splinter of wood within the globe is almost certain to cause the loss of the eye within a short period. In the first place, wood, unlike a fine particle of iron, is usually infected, and in the second place wood itself seems to be very toxic. Glass probably is the least injurious of all substances.

Eyes containing foreign bodies have been removed because the capsule or bed of the foreign body has been mistaken for a tumor. This is particularly the case with foreign bodies that have lodged in the stroma of the iris, where they may become surrounded by exuberant granulation tissue which in its rapid growth and shape may simulate a neoplasm or a tuberculous process. In a similar way, the capsule of a particle lodged on the inner surface of the ciliary body may cast a shadow on transillumination and lead to a suspicion of a malignant condition.

If a foreign body is seen suspended in the vitreous, there is not much chance of its remaining there, because its presence causes a liquefaction of the vitreous so that in time it will sink to the most dependent

part. A favorite seat for the finding of foreign bodies by accident in sectioning eyes is in their bed on the retina below just back of the ora serrata, representing the point to which they have sunk after the liquefaction of the vitreous. Foreign bodies on the retina, because of the contraction of their capsule, cause the retina to detach, and with this detachment the foreign body changes its position. Such possibilities of change of location are to be borne in mind in repeated roentgen examinations made from time to time.

Sooner or later hyaline and other degenerative changes are apt to take place in the fibrous capsule of a foreign body, causing it to break down. When this happens, the poisons generated by the foreign body itself and by the broken down tissue that is set free may produce active inflammation, and there may be set up sympathetic ophthalmia. An eye containing a foreign body is never to be considered out of danger.

WORKMEN'S COMPENSATION PROBLEMS. MR. V. A. ZIMMER, Director of the Division of Workmen's Compensation, Department of Labor, New York State.

This article appears in full in this issue of the ARCHIVES, p. 367.

THE PREVENTION OF INDUSTRIAL ACCIDENTS TO THE EYES AND ORBITS. MR. LEWIS H. CARRIS, Director of the National Society for the Prevention of Blindness, New York.

While no extensive, authentic statistics on the subject are available, there is reason to believe, from the voluminous data in the hands of the National Society for the Prevention of Blindness, that accidental injuries of the eye now constitute the greatest single cause of blindness. Simultaneous with the progress that has been made in the field of ophthalmology, there has proceeded a more or less steady increase in the frequency and severity of accidental ocular injuries, particularly as the result of occupational hazards.

Part of this increase is undoubtedly due to the greater machinization of industry, part to the general speeding up of the work of the individual man or woman in factories, and part to the tremendous increase in industrial life. But a very large part of the increase in industrial blindness is due to the fact that, while a comparatively few large corporations have given serious attention to accident prevention and so have brought about extraordinary reductions in all accidents, including those causing ocular injuries, the vast majority of industrial properties are still paying little attention to the actual prevention of accidents.

An analysis of ocular injuries in New York State during the last six years shows a more or less steady increase in the number of permanent total disability and permanent partial disability cases, from 2,247 in 1925 to 2,300 in 1930. The compensation paid for these injuries shows a slight reduction, from $1,902,000 in 1925 to $1,792,000 in 1930. There are numerous other evidences justifying the statement that, notwithstanding all the splendid accomplishments of the industrial safety movement, the problem of protecting the eyes of industrial workers is today as serious as, if not more serious than, five or ten years ago.

The sight of men and women in industry can be safeguarded by three means, and all three are vital: through mechanical devices, through training and education of workers, supervisors and managers in safe practices and through proper administration and supervision.

A recent analysis of the circumstances surrounding 70,000 accidents has led Heinrich, of the Travelers Insurance Company, to the conclusion that 98 per cent of all industrial accidents are preventable, and of these 88 per cent could be prevented by proper supervision and administration. In the majority of industries, safety is still an added frill,—something to be done so far as it will not interfere too seriously with production, labor relations or, even more, tradition. There is a great deal that the industrial physician or surgeon can do to help this situation indirectly; he can, often more effectively than the safety engineer, the insurance inspector or any one else, inspire the genuine and thoroughgoing interest of executives in the elimination of accident hazards as well as of disease hazards.

Because of the full program, no discussion was allowed.

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

ALGERNON B. REESE, M.D., *Secretary*

Nov. 16, 1931

MARK J. SCHOENBERG, M.D., *Chairman*

METHOD OF MAKING MACROSCOPIC EYE SPECIMENS: OSTEOLOGIC PREPARATIONS OF SPHENOID SINUS RELATIONS; TEMPORAL BONE WITH CELLS AROUND THE GROOVE FOR THE SIXTH NERVE. MR. EDWARD B. BURCHELL.

The demonstration consisted of different methods of preparing macroscopic specimens of the eye, and also ways of mounting foreign bodies for exhibition.

The laboratory eye record book was shown, demonstrating the way of correlating the past and present histories of the patient with the pathologic report on the microscopic sections of the enucleated globe. Drawings featuring the main points of pathology in the sections were shown, as well as the cross-index system and the file references.

The osteologic exhibit consisted of specimens of nasal bones, showing the variations in the formation of the sinuses and their close relationship to the orbit and to the foramen for the optic nerve. Temporal bones were also displayed, showing pneumatized pyramids, far forward sinuses, etc.

DISCUSSION

DR. SAMUEL KOPETZKY, New York: The specimen presented has a pneumatized petrosal pyramid tip with a rather unusual development of cells around the tract of the sixth nerve. Such an extensive cellular development, extending along the groove of the sixth nerve, is not usually encountered. This is an important feature of the specimen, because paralyses of the sixth nerve have engaged the attention of ophthalmologists and otologists for some time in connection with a discussion and study of the Gradenigo syndrome.

Originally, the Gradenigo syndrome was believed to be a clinical manifestation of meningitis. The specimens available were cases that came to autopsy; they showed a purulent infiltrate in the pyramidal tip. The conclusion drawn from this was that the Gradenigo syndrome was one of the characteristics of suppurations of the petrosal pyramid.

More recently, observers have been repudiating the theory that the Gradenigo syndrome is significant of any one clinical entity. In the studies that my associate, Dr. Ralph Almour, and I have made, we have separated the clinical manifestations of involvement of the sixth nerve from lesions confined within the petrosal pyramid, and have shown that while the suppuration is limited to the pyramid, the Gradenigo syndrome is not necessarily present. Only when the lesion extends beyond the bone and involves the meninges and Dorello's canal does involvement of the sixth nerve occur.

Anatomists are agreed that between 25 and 30 per cent of pneumatized temporal bones contain a pneumatized petrosal pyramid, and a specimen like the one presented, with the pneumatization extending along the tract of the sixth nerve, is unusual even among pneumatized tips. This is important when one seeks to estimate the diagnostic significance of involvement of the sixth nerve. It means that only in rare cases is paralysis of the sixth nerve a concomitant of suppuration within the petrosal pyramid. In most cases of petrosal suppuration, involvement of the sixth nerve occurs only after the lesion has extended beyond the limits of the pyramid and invaded the meninges. Nevertheless, in an unusual case, like the one represented in Mr. Burchell's specimen, it is possible for the sixth nerve to be involved, while the lesion is confined to the petrosal pyramid. This is only possible, however, when, as in Mr. Burchell's specimen, pneumatization has taken place in such a way as to leave cells around the tract of the sixth nerve.

THE FIRST FIFTY YEARS OF THE NEW YORK EYE AND EAR INFIRMARY, FROM 1820 TO 1870. DR. BERNARD SAMUELS, New York.

This article will be published in full in a later issue of the ARCHIVES.

AN IMPROVED OPHTHALMOTROPE. DR. WENDELL L. HUGHES, New York.

This ophthalmotrope is the result of a long-felt need for a model that will show the normal and pathologic actions of the external ocular muscles, individual or combined, and the effect of operations on any of the muscles. It is a further development of the model I presented at the ophthalmologic section of the New York Academy of Medicine.

early in 1929, which was found to be inadequate in some respects. The present model was shown at the American Academy of Ophthalmology in Chicago in October, 1930.

In teaching, it is useful in demonstrating the relative position of the eyes in the orbits, the anatomy and the effect on the eyeball of active stimulation of the various eye muscles, showing the mechanism of the primary actions of the respective elevators and depressors and where these primary actions are greatest. The secondary actions are easily explained by showing them on the model. The imitation of normal muscular action is further enhanced by the fact that when the eye is at rest, the springs representing the muscles are under slight tension, representing the normal tonicity of the eye muscle. When one "muscle" is activated that spring is shortened and the opposing ones are stretched, imitating the physiologic muscular contraction and relaxation according to Sherrington's law of reciprocal innervation. The eyes are activated by pulling on strings from the rear. Any desired paresis or paralysis may be shown by reducing the tension on the corresponding springs by adjustment of the separate tension springs that are retained by the tension control pegs at the rear, or by detaching the muscle from the eyeball.

An attachment to prevent a muscle from relaxing is provided to be used on the left lateral rectus muscle for representation of the retraction (or Duane) syndrome. By loosening a small setscrew at the back of the eye, a compression spring is brought into play and the eye is allowed to be retracted as well as to turn nasally when the medial rectus is activated.

The various operations for weakening or strengthening the actions of the muscles are demonstrable by the attachments provided, a resection or recession of any desired amount being readily shown. A convergent squint may be shown, and then the operation may be done on the model to correct the deformity. A divergent squint may likewise be shown and corrected.

The use of such a model is particularly for teaching purposes to undergraduate and postgraduate students of ophthalmic myology. It may also be used for demonstrating to patients what can be done at operations on the ocular muscles.

TWO CASES OF FAMILIAL DEGENERATION OF THE RETINA. DR. DAVID WEXLER, New York.

These cases of degeneration of the retina were in brothers, 10 and 13 years old, whose parents (both Italian) were first cousins. Both boys were normal mentally, and there was no other stigma of consanguinity. A younger sister had normal vision. Deterioration in vision began at 9 years in each boy, and had progressed so that at the time of presentation it was 10/200 in the older, and 20/200 in the younger, boy. The fundus lesion in each consisted of a pigmentary degeneration of the macular area, together with a number of ill defined, faintly pigmented, grayish spots about the central area and the disk, situated deep in the retina. The disks were normally pink, and the vessels were of the proper caliber.

Disturbance in vision in these cases probably depends on primary degeneration of the neuro-epithelium, so that central retinal degenera-

tion of this type may be grouped with retinitis pigmentosa. Other closely allied conditions are maculocerebral degeneration and the juvenile form of amaurotic family idiocy. Judging from Batten's description of the pathologic changes in the maculocerebral form of retinal disease, it is not unlikely that the advanced picture of the fundi in the present cases would resemble that of the fully established retinitis pigmentosa. Absence of pallor of the disks can be explained, first by the minimal degree to which the ganglion cells are affected at this early stage in the disease, and second by the normal state of the arteries, which has been confirmed by Batten, microscopically. This is in contradistinction to the early narrowing in retinitis pigmentosa, undoubtedly a factor in the rapid onset of pallor of the disks in this condition.

DISCUSSION

DR. HERBERT W. WOOTON, New York: I had the opportunity of observing three cases of this disease in one family about twenty years ago. They occurred at the Manhattan Eye, Ear and Throat Hospital in the clinic of the late Dr. E. L. Oatman. All three cases presented at first a stippled increase at the macula, which later extended to the greater part of the fundus. The macular stippling was in all cases followed by a central scotoma. The disease made its appearance shortly after the second dentition. One of the patients, the oldest, later developed cerebral symptoms, becoming imbecile. This patient died, but we could not obtain an autopsy. At that time no pathologic observations had as yet been made. Whether any eyes have been secured for microscopic examination since that time, I do not know. We did not associate this disease in any way with retinitis pigmentosa, and syphilis was not supposed to be a factor in its causation, or to be responsible for the cerebral degeneration and cerebral symptoms that were to follow.

AN UNUSUAL CORNEAL CONDITION. DR. WILLIAM B. DOHERTY, New York.

Over the pupillary area of the cornea of both eyes and extending around to within 2 or 3 mm. of the corneal margin was a somewhat diffuse opacity situated in the superficial and central part of the interstitial layer. It had a somewhat reticular, grill-like or lattice work appearance without nodules. The lattice work appeared, with the slit-lamp, as a concentration of small white dots with a diffusion of dots in the intervening spaces. A few old blood vessels could be seen traversing the opacity, while a few fine more superficial ones came from the corneal margin. The epithelium was unbroken, normal and extremely sensitive.

The right eye was blind; the pupil was dilated and did not react to light, but the consensual reflex was perfect. There were a brownish, dustlike pigmentation of the anterior capsule of the lens and fine floating opacities in the vitreous. The fundus presented a complete optic atrophy; the disk was filled with organized exudate, and the retinal vessels appeared as white connective tissue strands.

The left eye had pathologic changes similar to the right, only to a milder degree. The corneal opacity was slightly less dense; vision was limited to the perception of fingers at 5 feet (152.4 cm.); there was a

brownish, dustlike deposit of pigment on the anterior capsule of the lens; the optic nerve was atrophic, with marked constriction of the vessels and marked irregular contraction of the field.

RECORDING SLIT-LAMP FINDINGS. DR. HENRY MINSKY, New York.

This article will be published in full in a later issue of the ARCHIVES.

A SIMPLIFIED RETINAL MEASURING GRID. DR. ROBERT LAMBERT, New York.

This article appears in full in this issue of the ARCHIVES, p. 440.

EXTENSIVE IRIDODIALYSIS: AN OPERATION FOR REATTACHMENT. DR. BEN WITT KEY, New York.

This article will be published in full in a later issue of the ARCHIVES.

TOTAL BLINDNESS IN A CASE OF FRACTURE OF THE FRONTAL BONE: RECOVERY. DR. FRANCIS W. SHINE, New York.

A boy, aged 11, who was thrown from a bicycle, striking the left side of the head, was not knocked unconscious, but was dazed and remembered little of what happened. There was dizziness, but no vomiting; there was slight bleeding from the nose, but none from the ears. In four days vision started to fail, and on the fifth day he was completely blind.

When first seen, one week after the accident, physical and neurologic examinations gave normal results except for the eyes, which were amaurotic; both pupils were widely dilated and inactive; the media were clear. There was a mild papilledema in both eyes, with several small retinal hemorrhages at the nerve margins. Laboratory findings were normal except for x-ray pictures of the skull, which showed a fracture of the frontal bone on the left side, beginning at the brow near the angle of the orbit and running straight up for 2 inches (5 cm.), and a branch leaving the straight line about the middle and running off toward the middle line for about 1½ inches (3.77 cm.). The patient was in the hospital for about a month, and vision improved from blindness to 20/40 at the time of discharge. The swelling of the disks decreased to normal; the hemorrhages were completely absorbed. The symptoms in this case were probably due to the extravasation of the blood into the optic sheaths.

Other cases reported have shown: (1) fracture of the optic foramen with laceration of the dural sheath, or (2) extension into the intervaginal space from pressure. Apparently neither of these conditions was present in this instance.

DISCUSSION

DR. THOMAS H. JOHNSON, New York: The x-ray film would indicate that the orbital plate, which forms the floor of the anterior fossa, has not been fractured. There is no evidence of fracture of the orbital foramina. The hematoma developed in the tissues around the eye two days after the injury, and vision began to fail four days afterward,

which would indicate slow, continuous bleeding. The blood from a subdural hemorrhage could easily find its way along the floor of the anterior fossa, along the olfactory bulb or through the anterior commissure to reach the neighborhood of the optic foramina. It would not be necessary, in my opinion, for the blood to enter the optic canals. Subdural blood extending to the entrance of the nerves into the optic foramina could readily, by pressure, produce a loss of vision. Also, a blood clot pressing the first part of the optic nerve against the posterior margin of the orbital foramina might bring about a loss of vision. Cushing and de Schweinitz believe that pituitary tumors reduce vision not only by pressure on the chiasm, but by traction and pressure of the nerve against the tissues around the foramina. Proof of this is that there is often a return of vision after removal of the tumors with the consequent removal of pressure. I think that Dr. Shine's explanation is correct. The length of time it took the vision to return would correspond to the period during which one might expect a clot to be absorbed.

Dr. Samuel P. Oast, New York: A case bearing some resemblance to Dr. Shine's, at least in its effects on one eye, was published in one of the reports of the infirmary not long ago. It was that of a man, a carpenter, who received a blow from a large splinter of wood while chopping a piece of timber; the splinter struck him in the eye, just at the caruncle, and produced a severe penetrating wound of the orbit. I saw him the next day, and the wound could be probed to an extent of about 1 inch (2.5 cm.). There was no obvious injury to the globe itself and the fundus was always normal; no fracture was seen by roentgen examination. Hand movements were recorded at the time I saw the patient, and vision gradually increased so that at the end of six weeks the central vision and fields had returned to normal. I explained the case at the time as hemorrhage in the sheath of the optic nerve. Of course, there was no direct evidence of such a hemorrhage.

Dr. Sigmund Agatston, New York: I think that Dr. Shine was rather fortunate in getting such a good result. I explained loss of vision in a similar way in a case I had, but my result was not as good as his. I could not get a complete return of vision, or even useful vision. I think that hemorrhages into the optic nerve sheath, subdural hemorrhages, as Dr. Johnson has explained, are seen frequently, but in the majority of cases optic atrophy is caused.

Dr. Joseph Sheldon Somberg, New York: I would like to ask Dr. Shine whether a spinal fluid tap was done on the patient. I think that is important in determining whether there was an actual orbital hemorrhage, or an actual intracranial hemorrhage. I have seen a good many cases of hemorrhage into the optic sheath, and they are more common than we think they are. Sometimes the patient may, after a serious injury, develop bilateral optic atrophy. In other patients who have a slight injury, retrobulbar neuritis may develop without any signs of hemorrhage. I saw one patient who had received the injury eight months before, in whom optic atrophy developed.

Dr. Francis W. Shine: I was interested in hearing Dr. Johnson's statement that the same symptoms might be produced through the extravasation of blood that did not reach the optic canal. He suggested

that such would be the case through pressure, but if that were true, then there should be other signs of intracranial pressure, and this case of mine showed absolutely none. Therefore, I think that the blood must have filtered into the subdural sheaths of the nerve.

In regard to the question about spinal tap, none was done. There was no indication for it, because the boy was absolutely well from the time he entered the hospital until he left, except for the ocular symptoms.

TECHNIC OF DACROCYSTORHINOSTOMY. DR. WEBB WEEKS.

This article appears in full in this issue of the ARCHIVES, p. 443.

COMPLETE DISCISSION OF THE CRYSTALLINE LENS. DR. CONRAD BERENS, New York.

This case was shown before the meeting, but was not formally presented.

Dr. Berens presented two patients on whom he had performed complete discission of the crystalline lens. One patient had congenital cataracts and the other a traumatic cataract. There was a good central opening in the capsule in two eyes and round active pupils in all three of the eyes operated on.

In one eye there was a beginning secondary membrane which will probably require a second operation. Dr. Berens has found it necessary to operate on a secondary membrane in three cases, which is not in accord with the experience reported by S. L. Ziegler. (Complete Discission of the Lens by the V-Shaped Method, *J. A. M. A.* **77:** 1100 [Oct. 1] 1921.)

The patients were presented because complete discission of the lens has been criticized by several eminent surgeons, and Dr. Beren's experience with nineteen patients on whom he operated and eighty observed cases of other surgeons does not support the contention that complete discission is dangerous. The technic he uses differs from Ziegler's original technic in that a subconjunctival incision is used and a single straight incision is substituted for Ziegler's inverted V-shaped incision. The dilatation of the iris is fortified with epinephrine. He stressed the importance of the preliminary examination, especially the Wassermann test and intradermal tests with lens antigen.

The advantages over the older methods of operating seem to be that there is usually less reaction and hypertension; danger of infection is also less, because fewer operations are required to obtain the same results. It seems unnecessary to perform preliminary iridectomy, and it is certainly not as important a procedure as when anterior capsulotomy is performed.

INTRA-OCULAR TUMOR FOR DIAGNOSIS. DR. WENDELL L. HUGHES, New York.

This case was shown before the meeting, but was not formally presented.

Miss C. B., aged 23, gave a history of having had a "spot on the pupil" as long as she could remember. She thought that it has been getting larger in the past six months, and four days prior to presentation

she noticed a small dark spot in front of the light mass that had been present previously. Since this had appeared, there had been a little irritation of the eye with the feeling of a foreign body in the eye. Examination showed a light pinkish mass protruding between the root of the iris and sclera at about seven o'clock position. It was a little more than 3 mm. across at the base and extended to the pupillary margin, lying on the anterior surface of the iris. Near its top on the interior surface was a dark spot, which was a small hemorrhage. Numerous blood vessels could be seen on the surface of the mass. The iris did not dilate in this region under the influence of homatropine, the dilated pupil being eccentric on this account. The contracted pupil was centrally placed and active to light and in accommodation.

The slit-lamp revealed a perfectly normal aqueous, with no deposits on the posterior corneal surface. There were many blood vessels throughout a pedunculated mass. There was some disturbance of the pigment of the iris at each side of the attachment, near the limbus. The lens was not displaced. The vitreous was clear. In the fundus a light streak could be seen running from about 4 disk diameters below and temporally toward the position of the tumor, as far as could be seen. This, however, did not appear elevated, and there was no interference with transillumination. Vision in each eye with correction for astigmatism was 20/25. Tension was normal. The Wassermann reaction was negative. General physical examination gave negative results.

A stereoscopic picture had been taken so that an accurate record could be had for future comparison.

The long history and appearance of the tumor suggest the possibility of a hemangioma. This case is presented for suggestion as to diagnosis, but more particularly as to what line of treatment should be followed.

NOTE.—Transillumination with the Zeiss Skleralamp applied over the sclera body in the region of the mass showed no defect. When the Skleralamp was placed at the equator of the eye on the opposite side, all the sclera processes could be made out, and there appeared to be no irregularity in the shadows, as seen through the sclera externally.

ROYAL SOCIETY OF MEDICINE, LONDON, SECTION OF OPHTHALMOLOGY

H. DICKINSON, *Reporter*

ELMORE W. BREWERTON, F.R.C.S., *President, in the Chair*

Nov. 13, 1931

SARCOMA OF THE CHOROID. MR. HUMPHRY NEAME.

Mr. Neame thought that the growth in the choroid in this case merited being diagnosed as malignant because of its solidity, its increase in size in a fortnight, the presence of irregular pigmentation on the lower

surface and the numerous vessels. Two years before, the patient noticed that she had a different color perception in the two eyes; on looking at yellow flowers, one eye saw them much paler than the other did. Also, with the good eye covered, a medicine bottle looked smaller than when both eyes were used. That indicated a definite pushing forward of the retina by the growth. The patient had been slightly myopic in that eye, but now she had 4 diopters of hypermetropia.

DISCUSSION

MR. ELMORE W. BREWERTON: I consider this a typical case of sarcoma. The eye should be removed as soon as possible.

MR. NEAME: I intend to remove the eye tomorrow.

SWELLING OF THE LID. MR. FOSTER.

When first examined, six weeks before presentation, the patient had a painful eyelid. Later a swelling appeared on the lower lid, but the pus from it was lost when it was opened. The Pirquet test produced a strong reaction and an increased swelling. The condition was therefore assumed to be tuberculous dacryadenitis of the upper lid. The patient had been struck on the eyelid by a tennis ball, but no cut resulted.

DISCUSSION

MR. J. H. FISHER: At the bottom of the sinus there may be a small foreign body, driven in at the time of the accident. I suggest making a semicircular incision around the outer canthus and exploring this region. A lacrimal gland is not necessarily the cause of the trouble.

WORM IN THE ANTERIOR CHAMBER. MR. M. S. MAYOU.

While fighting in Gallipoli the patient was struck by a fragment of exploded shell, but he did not go to a dressing station. His first appearance for advice was when he entered the Central London Ophthalmic Hospital to be tested for glasses. The presence of a worm in ordinary tissues results in a calcareous condition of the surrounding tissues, but this is not necessarily true of the anterior chamber.

DISCUSSION

PROF. R. T. LEIPER: There is nothing to indicate that the worm was not present before the injury; it might have been in the eye previously and have become involved in the scar tissue that formed as a result of the accident. It is unusual to find parasites in the anterior chamber of the eye, and none of the cases of the kind on record were fully studied by medical zoologists. Viewed with my own lens this object seemed to closely resemble a nematode worm. One end of the worm, however, seemed to be coiled on itself. Worms are sometimes found in the anterior chamber of the eyes of horses, but the life history involves biting by an insect. This man may have been bitten by an insect while he was in southeastern Europe.

CATARACT IN AN ACETONE FACTORY. MR. M. S. MAYOU.

A boy, 18½ years of age, had been a paint-sprayer for six months. He complained, when seen, that his vision had been blurred for seven weeks. Apparently a cataract had occurred while the boy was at work. In the right eye there was a typical diabetic cataract. In the other eye capsular changes were seen all around the lens. A month after the patient ceased work there was no acetone or sugar in the urine.

DISCUSSION

MR. ELMORE W. BREWERTON: If this kind of painting causes cataract, such cases should be much more common.

RAPID CURE OF GONORRHEAL CONJUNCTIVITIS. MR. LINDSAY REA.

A nurse in the Lock Hospital contracted blenorrhea in the course of her work. Gonococci were freely present in the pus from both eyes. In ten days she was cured, the only treatment having been almost continuous irrigation with 10 per cent magnesium sulphate.

DISCUSSION

SIR ARNOLD LAWSON: The antiseptic property of the substance used is not the important matter; it is the irrigation, so that no discharging pus is given the opportunity to settle and do mischief in the eye. I have brought such patients practically out of danger in forty-eight hours by having relays of nurses irrigate the eye, first every half hour and then every hour.

MR. M. S. MAYOU: On the basis of my experience with about 250 cases of gonorrheal infection of the eye every year, I agree that in the early acute stage no silver nitrate but only mild washes should be used; I find silver nitrate useful at the later, clearing-up stage. It is also valuable to fill the conjunctival sac with acriflavine hydrochloride, 1:1,500, in castor oil. This protects and lubricates the cornea.

EPIBULBAR GROWTH. MR. C. GOULDEN.

A man, 76 years of age, had an epithelioma removed from the lip, twenty years before; glands were also dissected from the neck, and two growths, probably rodent ulcers, removed from the left cheek. The cornea had become opaque in front of the edge of the present growth. In a second patient, a man aged 81, a much larger growth was present. It was very vascular.

DISCUSSION

MR. ELMORE W. BREWERTON: Both the cases are malignant. I should advise removal without delay.

MR. TREACHER COLLINS: In a similar case, instead of removing the eye as desired, I cut off the growth as close to the cornea as I could, and then treated the eye with radium. I followed the case up for a long time. There was no return of the growth, and an excellent scar was left. Eventually the man died of a different disease. The hard tissue of the cornea resisted the downward course of the growth for a long

time. These growths tend to spread over the surface and backward into Tenon's capsule. If they get into the vessel, they may spread into the canal of Schlemm.

SOME POINTS IN THE FITTING OF CONTACT GLASSES. MR. RUGG GUNN.

This paper was briefly discussed.

THE USE OF ANTISEPTICS. MR. FREDERICK RIDLEY.

The use of antiseptics in the conjunctival sac was considered. Confining oneself to the problem of destroying demonstrable bacteria in the conjunctival sac, the problem can be stated as follows: First, will the antiseptic destroy the organisms before it is rendered ineffective by dilution in tears? Second, during what subsequent period will it inhibit the growth of the organism, taking into account the further dilution? Third, does the antiseptic destroy the natural protective agent lysozyme? And further, if so, is this effect operative in greater dilution than that which is at least inhibitory to the bacteria? An experiment showed that, even in the normal eye and with the minimum of irritation, the fluorescein that could be introduced into the conjunctival sac was diluted thirty-two times in eleven minutes. This rate of dilution followed an arithmetical progression, i. e., a fixed quantity of fluorescein by weight was eliminated in a unit of time. This rate of dilution applies to the dyes that are adsorbed; most substances, e. g., mild silver protein, are diluted in geometrical progression, approximately one half every forty seconds.

The medium in which the antiseptic had to act was also fixed, except in the case of prolonged irrigation when an undine or eye bath was used. It was almost identical with physiologic solution of sodium chloride to which 10 per cent of serum had been added.

Many substances were tested, including zinc sulphate, mercuric chloride, mercuric iodide, copper sulphate, silver nitrate, silver protein, phenol, boric acid, cocaine and mercurochrome-220 soluble; the only microbes tested were staphylococci and streptococci. All the substances were tesed in a medium comparable to tears, and only silver nitrate destroyed the organisms in the time available before it was rendered ineffective by dilution in tears. Silver nitrate applied in 1 or 2 per cent strength may destroy the organisms with which it is brought in contact. Usually the beneficial action of silver nitrate is ascribed to the desquamation that it causes, and it has been said that it can have no antiseptic action since it is converted into the insoluble chloride by the sodium chloride of the tears and tissues. In the present experiment it was in the form of chloride, and was combined with protein; none the less, it was an effective germicide.

A substance introduced into the conjunctival sac may prevent the growth of organisms in it for a considerable time, in spite of the dilution. In this study, it became evident that only silver nitrate and silver protein were likely to possess value under this heading. Silver nitrate inhibited growth when used in great dilution, but it was precipitated in the superficial layers of the conjunctiva, and could reasonably be assumed to exert a powerful inhibiting action until the desquamating cells were themselves washed away.

Silver nitrate destroyed the lysozyme in high dilution, but a concentration of 1:25,000, which was actively inhibitory, did not appreciably affect the bactericidal power of tears. Silver protein did not destroy lysozyme.

The object of this inquiry was to determine by experiment the value of the antiseptics commonly made use of. They were tested only on staphylococci and streptococci, and their value was ascertained only in the free fluid of the conjunctival sac and on the surface of the conjunctiva. With those limitations in mind, it can be said that only silver nitrate and silver protein have any antiseptic action, and the first-named drug is by far the most efficient. The research suggests that silver nitrate can beneficially be used in much weaker concentrations than those usually employed. In that case the pain associated with its use can be practically eliminated.

DISCUSSION

MR. ELMORE W. BREWERTON: I am glad to hear that the old-fashioned remedy, silver nitrate, is still useful. I am strongly in favor of very weak silver nitrate; I often paint lids with it, in the strength of 1 grain (64.8 mg.) to the ounce, and I find it very useful.

SIR ARNOLD LAWSON: Mr. Ridley's paper seems to confirm what I said earlier in the meeting, that for suppurative conditions in the eye antiseptics are useless. Of the antiseptics in use, I am most interested in acriflavine hydrochloride, which I regard as an inhibitor. I do not think that either acriflavine hydrochloride or proflavine is of any practical use when infection is established, for then the infection must largely run its course. Saline solution and other nonirritant substances are as good as anything else for irrigating the eye. In cases of cataract I place a pad soaked with acriflavine hydrochloride over the eye, changing it twice a day; this prevents the ciliary borders from becoming dirty.

MR. M. S. MAYOU: I have frequently taken cultures from the conjunctival sac before performing a cataract operation, and found staphylococcus present. Treatment with silver protein did not clear up this infection, but the operation yielded good results. The secret lay in the fact that not every part of the conjunctiva contains the same number of organisms. In an investigation twenty years ago, I found that the upper fornix is practically always sterile; the tears seem to keep it clean. The lower conjunctival sac and the caruncle always bear many organisms.

Book Reviews

Detachment of the Retina. By J. Ringland Anderson, Melbourne, Australia. Foreword by Sir John Herbert Parsons. Price, $6.50. Pp. 207. New York: The Macmillan Company, 1931.

Since 1722, when detachment of the retina was first described by St. Yves, it has been of increasing interest to ophthalmologists. Much work, both speculative and experimental, has been done since that time In view of the recent impetus given to the study of detachment, due chiefly to the results obtained with the new operative procedure of Gonin, this monograph is timely. Dr. Anderson not only has undertaken the tedious and onerous task of investigating more than eight hundred original papers on the subject of detachment, but has also made his findings available for all in the present volume.

After a general discussion of detachment of the retina, the history, age distribution and incidence of association with myopia of varying degrees, the author summarizes the pertinent anatomy and physiology of the retina. Krogh's work on capillaries is cited as evidence that it is probably the capillaries rather than the ciliary epithelium that regulate the ocular tension. Ordinarily these are impermeable to colloids, but under the effect of inflammation, toxins or poisons or as a reaction to heat, light, drugs or any irritant or stimulus, the capillaries can dilate, their walls can be so damaged that edema or hemorrhage may occur, or there may be profound changes in the tension. The fact that light causes the pigment epithelium to send cilia-like processes between the rods and cones was the basis for Stargardt's recommendation that, after operation, the eye should be illuminated. Dr. Anderson recalls the fact, also, that the vitreous is adherent to the retina in the region of the ora serrata. On this fact, Leber based his theory that detachment was due to the formation of fibrous bands following a low grade cyclitis. According to Leber, epithelial cells proliferated from the ciliary body as a result of a slight inflammation of the pars plana. After spreading over the retina and into the vitreous, they became degenerate, and formed fibrous bands that, shrinking, aided in the destruction of the solid vitreous —"fibrillary degeneration of the vitreous." Contraction of these bands was supposed to cause a retinal tear, and later, when fluid passed through, retinal detachment occurred. Müller, de Wecker and Nordenson supported this theory. Later, with von Hippel, Leber developed a theory of "preretinitis" whereby an inflammatory membrane first united retina and vitreous, and then, shrinking, caused retinal tears through which fluid could pass, or merely raised the retina into folds under which fluid could collect by transudation. This theory made unnecessary the existence of a previous cyclitis with subsequent connective tissue formation. Gonin has modified this theory, adding, as a factor, adhesions of the retina and vitreous as a result of chorioretinitis in the equatorial zone. Heine's microscopic examination of one hundred myopic eyes with detachment supported Gonin's views, namely, that equatorial choroiditis was a frequent cause of myopic detachment of the retina.

A fertile field for speculation is briefly discussed, the phenomenon of turgescence and deturgescence of the vitreous. The vitreous occupies four fifths of the globe, and its turgescence undoubtedly helps maintain the retina against the choroid. Since it is a protein-colloid system, its ability to retain water and swell or shrink depends on three factors; its iso-electric point, the p_H of the blood and its own p_H. It seems to have two iso-electric points: one at p_H 3.8 and another at p_H 9.4, instead of at p_H 4.4 as was supposed in 1925. The normal p_H of blood is 7.35-7.40, while the p_H of normal vitreous is 7.5-7.7. If the blood or the vitreous p_H is lowered, the turgidity and osmotic pressure of the vitreous will fall with a resultant drop in intra-ocular tension and a lessening of the support for the retina. Likewise, if the iso-electric point of the vitreous were shifted to a more alkaline p_H, the vitreous would shrink, even if the blood and vitreous p_H remained unaltered. Moreover, the salt content of the blood can affect the volume of the vitreous, the p_H of blood and vitreous and the iso-electric point of the vitreous remaining unchanged, because the intravenous injection of hypertonic solutions causes a fall in intra-ocular tension; when hypotonic solutions are used, a rise in tension occurs. In addition, the vitreous contains at least three different proteins, each with its own iso-electric point. In degenerative conditions of the vitreous, its proteins are probably altered in both quantity and quality with resulting changes in its iso-electric point (or points). Since the p_H of the blood is relatively unchanged, except in definite cases of acidosis or alkalosis, and since the p_H of the vitreous is directly dependent on that of the blood, it is probable that variations in the iso-electric point (or points) of the vitreous are the ultimate cause of a variation in the turgescence of the vitreous. As Duke-Elder states elsewhere, this phase of experimental work, correlated with clinical observation, "promises a wide and fruitful field of inquiry."

The pathogenesis of detachment is considered under four headings representing four factors, each of which, at one time, was vigorously supported (and as vigorously opposed) as the cause of detachment of the retina. At present, these theories of distention, attraction, depression and exudation serve as a convenient means of classifying detachments. Each seems to fit a number of cases, but convincing arguments can be marshaled against each one.

Dr. Anderson sums up the question fairly and tersely when he says that there is a variety of causes, just as there is a variety of conditions as regards the presence or absence of holes and tears, the condition of the intra-ocular tension and the presence of associated disease. Holes are important only in that if a cure results after their closure, their existence must have borne a close relationship to the development of the detachment. In the absence of trauma, the retina may be pushed away from the choroid, lifted from it by fluid passing through a hole or tear or pulled from it by connective tissue. The hole may be due to cystoid degeneration, or to the traction of an adherent and degenerative vitreous or (rarely) a tissue band. Cases "of idiopathic" detachment may be due to alterations in the tissues from an equatorial retinochoroiditis, or to a choroidal effusion, the latter having a better prognosis, since the lesion producing the detachment sets up a reaction that tends to cure the detachment.

The author then briefly discusses differential diagnosis and the various treatments and operative procedures that have been or are still

being used for detachment. Several methods of localizing the tear are included. A short chapter on prognosis and a brief résumé of the topographic anatomy of the eye complete the book. This résumé was taken practically word for word, without definite acknowledgment, from an article by Dr. Mark J. Schoenberg, which appeared in the ARCHIVES in June, 1930. This omission was undoubtedly due to an oversight.

The book is concisely written; the writer is clear without being redundant, and he has presented many opposing points of view without undue bias. This monograph deserves a place on the bookshelf of every ophthalmologist.

W. F. DUGGAN.

Stereoskopischer Atlas der äusseren Erkrankungen des Auges nach forbigen Photographien für Studium und ärztliche Fortbildung mit begleitendem Text. By Karl Wessely. Price, 12 marks. Munich: J. F. Bergmann, 1930.

The fourth part of this "Stereoscopic Atlas" presents the following conditions: pterygium, epithelial tumor of the limbus, lacrimal fistula following injury to the skull, xerophthalmia following trachoma, melanosarcoma of the choroid, tuberculous iritis, zonular cataract, luxation of a calcified lens into the anterior chamber, metallic foreign body in the anterior chamber and vaccinia of the lids.

The excellence of the colored photographs is maintained, and the new series shows many interesting pictures.

A. K.

Directory of Ophthalmologic Societies *

FOREIGN

British Medical Association, Section on Ophthalmology

President: Sir J. Herbert Parsons, 54 Queen Anne St., Cavendish Square, London, W. I.
Place: London. Time: July 27-29, 1932.

Ophthalmological Society of the United Kingdom

President: Mr. A. H. H. Sinclair, 6 Charlotte Square, Edinburgh.
Secretary: Mr. Humphrey Neame, 56 Portland Place, London, W. I.
Place: Edinburgh. Time: May 12-14, 1932.

Oxford Ophthalmological Congress

Master: Dr. Cyril Walker, Bristol, England.
Secretary: Dr. C. G. Russ-Wood, 12 St. John's Hill, Shrewsbury, England.
Place: Oxford. Time: July 7-9, 1932.

Société Française d'Ophthalmologie

Secretary: Dr. René Onfray, 6 avenue de la Motte Picquet, Paris 7è.
Place: Paris. Time: July 17-21, 1932.

German Ophthalmological Society

Secretary: Prof. A. Wagenmann, Heidelberg.
Place: Leipzig. Time: May 19-21, 1932.

International Ophthalmologic Congress

Secretary: Dr. E. Marx, Rotterdam, Holland.
Place: Madrid, Spain. Time: 1933.

NATIONAL

American Medical Association, Section on Ophthalmology

Chairman: Dr. Harry Friedenwald, 1212 Eutaw Pl., Baltimore.
Secretary: Dr. Parker Heath, 1551 Woodward Ave., Detroit.
Place: New Orleans. Time: May 11-13, 1932.

American Academy of Ophthalmology and Oto-Laryngology

President: Dr. S. Hanford McKee, 1528 Crescent St., Montreal, Canada.
President-Elect: Dr. B. R. Shurley, 62 W. Adams Ave., Detroit.
Executive Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.
Place: Montreal, Canada. Time: September 19-23, 1932.

American Ophthalmological Society

President: Dr. Edward C. Ellett, 130 Madison Ave., Memphis, Tenn.
Secretary: Dr. Emory Hill, Professional Bldg., Richmond, Va.
Place: New London, Conn. Time: June 27-29, 1932.

SECTIONAL

New England Ophthalmological Society

President: Dr. David W. Wells, Hotel Westminster, Boston.
Secretary-Treasurer: Dr. Theodore L. Terry, 243 Charles St., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY

President: Dr. W. F. Hoffman, 317 Summit Ave., Seattle.
Secretary-Treasurer: Dr. Frank Friesen, 1208 Roosevelt Bldg., Los Angeles.
Place: Seattle. Time: June 30-July 2, 1932.

PUGET SOUND ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. John H. Harter, 1215 Fourth Ave., Seattle.
Secretary-Treasurer: Dr. Francis A. Brugman, 806 Cobb Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

SIOUX VALLEY EYE AND EAR ACADEMY

President: Dr. John B. Gregg, 101 S. Main St., Sioux Falls, S. Dakota.
Secretary-Treasurer: Dr. F. H. Roost, 420 Trimble Bldg., Sioux City, Iowa.
Place: Sioux City, Iowa. Time: November, 1932.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Wiley R. Buffington, 211 Camp St., New Orleans.
Secretary: Dr. William D. Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Place: Birmingham, Ala. Time: November, 1932.

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President: Dr. C. Ward Ellis, 215 N. Walnut St., Lansing.
Secretary: Dr. H. B. Weinburgh, 301 Seymour St., Lansing.
Time: Third Thursday of alternate months.

STATE

COLORADO OPHTHALMOLOGICAL SOCIETY

President: A presiding officer is selected for each meeting alternatelv until all members have served.
Secretary: Dr. Ralph W. Danielson, 258 Metropolitan Bldg., Denver.
Place: Capitol Life Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. M. H. Merriman, 115 Prospect St., Waterbury.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.
Time: May, November.

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

President: Dr. W. L. McDougall, 50 Whitehall St., S. W., Atlanta.
Secretary-Treasurer: Dr. W. O. Martin, Jr., 412 Medical Arts Bldg., Atlanta.

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President Dr. J. R. Gillum, 221 S. Sixth St., Terre Haute.
Secretary: Dr. J. Kent Leasure, 23 E. Ohio St., Indianapolis.

IOWA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Royal French, 28 S. First Ave., Marshalltown.
Secretary-Treasurer: Dr. W. F. Boiler, 105 E. Iowa Ave., Iowa City.

MICHIGAN STATE MEDICAL SOCIETY, SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman: Dr. Wilfred Haughey, 303 Post Bldg., Battle Creek.
Secretary: Dr. H. O. Westervelt, 239 Pipestone St., Benton Harbor.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Douglas F. Wood, 74 S. Ninth St., Minneapolis.
Secretary-Treasurer: Dr. Walter E. Camp, Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month from October to May.

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY

President: Dr. L. H. Huber, Livingston.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.

NEW JERSEY STATE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY, OTOLOGY AND RHINOLARYNGOLOGY

Chairman: Dr. H. L. Harley, 101 S. Indiana Ave., Atlantic City.
Secretary: Dr. B. E. Failing, 31 Lincoln Park, Newark.
Place: Atlantic City. Time: June 15-17, 1932.

NEW YORK STATE MEDICAL SOCIETY, EYE, EAR, NOSE AND THROAT SECTION

Chairman: Dr. R. T. Atkins, 4 W. Fifty-Third St., New York.
Secretary: Dr. D. F. Gillette, 109 S. Warren St., Syracuse.
Place: Buffalo. Time: May 23-24, 1932.

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. F. L. Wicks, Valley City.
Secretary-Treasurer: Dr. W. L. Diven, National Bank Bldg., Bismarck.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. H. M. Hendershott, 193 Eleventh St., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. Frank W. Dimmitt, 195 Thayer St., Providence.
Secretary: Dr. N. A. Bolotow, 108 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

SOUTH CAROLINA MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. W. B. McWhorter, 106 E. Earle St., Anderson.
Secretary-Treasurer: Dr. G. M. Truluck, Orangeburg.
Time: April and December.

TEXAS, OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. W. D. Jones, 3116 Live Oak St., Dallas, Texas.
Secretary: Dr. A. F. Clark, 1034 Nix Professional Bldg., San Antonio.

UTAH OPHTHALMOLOGICAL SOCIETY

President: Dr. D. W. Henderson, 75 S. Main St., Salt Lake City.
Secretary-Treasurer: Dr. T. F. Welch, 14 Exchange Pl., Salt Lake City.

VIRGINIA SOCIETY OF OTO-LARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. C. P. Jones, Newport News.
Secretary-Treasurer: Dr. H. G. Preston, 307 Professional Bldg., Harrisonburg.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. G. A. Smith, Montgomery.
Secretary: Dr. O. H. Bobbitt, Medical Arts Bldg., Charleston.

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Charles W. Buvinger, 50 Washington St., East Orange.
Secretary: Dr. Earl LeRoy Wood, 192 Roseville Ave., Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

ACADEMY OF MEDICINE OF TORONTO, SECTION OF OPHTHALMOLOGY

Chairman: Dr. P. J. F. Houston, 34 Hurndale Ave., Toronto.
Secretary: Dr. Alexander E. MacDonald, 151 Bloor St., W., Toronto.
Time: First Monday of winter months.

ATLANTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. John R. Childs, 45 Edgewood Ave., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., Medical Arts Bldg., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

BALTIMORE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY

Chairman: Dr. Alan C. Woods, 906 Cathedral St., Baltimore.
Secretary: Dr. Henry F. Graff, 513 N. Charles St., Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

President: Dr. John N. Evans, 23 Schermerhorn St., Brooklyn.
Secretary: Dr. Michael J. Buonaguro, 589 Lorimer St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday in February, April, May, October and December.

BUFFALO OPHTHALMOLOGIC CLUB

President: Dr. Joseph C. O'Gorman, 1324 Jefferson Ave., Buffalo.
Secretary-Treasurer: Dr. Thurber Le-Win, 112 Linwood Ave., Buffalo.

CHICAGO OPHTHALMOLOGICAL SOCIETY

President: Dr. Michael Goldenburg, 104 S. Michigan Ave., Chicago.
Secretary: Dr. Richard C. Gamble, 30 N. Michigan Ave., Chicago.
Place: Medical and Dental Arts Club. Time: Third Monday of each month from October to May.

CLEVELAND ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

Chairman: DR. M. W. Jacoby, 2323 Prospect Ave., Cleveland.
Secretary: Dr. H. C. Rosenberger, 1065 Rose Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

CLEVELAND OPHTHALMOLOGICAL CLUB

Chairman: Dr. Roy B. Metz, Hanna Bldg., Cleveland.
Secretary: Dr. Paul G. Moore, Medical Arts Bldg., Cleveland.

COLLEGE OF PHYSICIANS, PHILADELPHIA, SECTION ON OPHTHALMOLOGY

Chairman: Dr. L. F. Appleman, 308 S. Sixteenth St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

COLUMBUS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

Chairman: Dr. Ivor Clark, 188 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. Francis W. Thomas, 327 E. State St., Columbus, Ohio.
Time: First Monday of each month.

DALLAS ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. L. M. Sellers, 717 Pacific Ave., Dallas, Texas.
Executive Secretary: Dr. W. Mood Knowles, 717 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

DES MOINES ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Cecil C. Jones, 1121 Equitable Bldg., Des Moines, Iowa.
Secretary-Treasurer: Dr. Grace Doane, 614 Bankers Trust Bldg., Des Moines, Iowa.
Time: 7:45 p. m., third Monday of every month, September to May.

DETROIT OPHTHALMOLOGICAL CLUB

Chairman: Members rotate alphabetically.
Secretary: Dr. Raymond S. Goux, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

EASTERN NEW YORK EYE, EAR, NOSE AND THROAT ASSOCIATION

President: Dr. F. M. Sulzman, 1831 Fifth Ave., Troy.
Secretary-Treasurer: Dr. Arthur F. Holding, 142 Washington Ave., Albany.
Time: Third Wednesday in October, November, March, April, May and June.

FORT WORTH EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. R. H. Needham, 1304 Medical Arts Bldg., Fort Worth, Texas.
Secretary-Treasurer: Dr. Van D. Rathgeber, 1011 Medical Arts Bldg., Fort Worth.
Place: University Club. Time: 6:30 p. m., first Friday of each month except July and August.

GRAND RAPIDS EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. Carl F. Snapp, 26 Sheldon Ave., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Walter W. Oliver, 26 Sheldon Ave., Grand Rapids, Mich.
Place: Various local hospitals. Time: Third Thursday of alternating months, September to May.

HOUSTON ACADEMY OF MEDICINE, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. L. W. Raney, 609 Fannin St., Houston, Texas.
Secretary: Dr. J. F. Gamble, 201 Main St., Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of each month from September to June.

INDIANAPOLIS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. B. J. Larkin, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

KANSAS CITY SOCIETY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. W. E. Keith, 1103 Grand Ave., Kansas City, Mo.
Secretary: Dr. O. S. Gilliland, Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

LONG BEACH EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. R. R. Montgomery, 102 Pine Ave., Long Beach, Calif.
Secretary-Treasurer: Dr. Russell T. Uhls, 823 Security Bldg., Long Beach, Calif.
Place: Pacific Coast Club. Time: Last Wednesday of each month from September to June.

LOS ANGELES COUNTY MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. J. Frank Friesen, 1208 Roosevelt Bldg., Los Angeles.
Secretary-Treasurer: Dr. F. H. Brandt, 1052 W. Sixth St., Los Angeles.
Place: Mary Louise Cafe. Time: 6:30 p. m., fourth Monday of each month from October to May, inclusive.

Medical Society of the District of Columbia, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. James A. Flynn, 1511 Rhode Island Ave., Washington.
Secretary: Dr. E. R. Gookin, Medical Science Bldg., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month.

Memphis Society of Ophthalmology and Oto-Laryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month. Annual meeting, Jan. 10, 1933.

Milwaukee Oto-Ophthalmic Society

President: Dr. T. F. McCormick, 324 Wisconsin Ave., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 324 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Hilliard Wood, 700 Church St., Nashville, Tenn.
Secretary-Treasurer: Dr. H. C. Smith, Medical Arts Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month.

New Orleans Ophthalmological and Otological Society

President: Dr. Charles A. Bahn, 150 Baronne St., New Orleans.
Secretary-Treasurer: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. Mark J. Schoenberg, 1160 Park Ave., New York.
Secretary: Dr. Algernon B. Reese, 73 E. Seventy-First St., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

Omaha and Council Bluffs Ophthalmological and Oto-Laryngological Society

President: Dr. William P. Haney, 107 S. Seventeenth St., Omaha.
Vice President: Dr. L. G. Howard, 532 First Ave., Council Bluffs, Iowa.
Secretary-Treasurer: Dr. W. A. Cassidy, 1620 Medical Arts Bldg., Omaha.
Place: University Club, 1914 Harney St., Omaha. Time: 6 p. m., dinner; 7 p. m., program; third Wednesday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Pittsburgh Slit-Lamp Society

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: 121 University Pl. Time: Second Monday evening of every month, except June, July, August and September.

Richmond Ophthalmological and Oto-Laryngological Society

President: Dr. William R. Weisiger, Medical Arts Bldg., Richmond, Va.
Secretary: Dr. R. W. Vaughan, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. E. S. Amsler, 53 S. Fitzhugh St., Rochester, N. Y.
Secretary-Treasurer: Dr. E. W. O'Brien, 5 N. Goodman St., Rochester, N. Y.
Place: Rochester Medical Association, 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. Julius H. Gross, Carleton Bldg., St. Louis.
Secretary: Dr. Carl T. Eber, 1006 Carleton Bldg., St. Louis.
Place: Oscar Johnson Institute. Time: Clinical meeting 5:30 p. m., dinner and scientific meeting 6:30 p. m., fourth Friday of each month from October to April, inclusive, except December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Scott C. Applewhite, 705 E. Houston St., San Antonio, Texas.
Secretary-Treasurer: Dr. E. D. Dumas, 425 Medical Arts Bldg., San Antonio.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Robert C. Martin, 384 Post St., San Francisco.
Secretary: Dr. George N. Hosford, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco.
Time: Third Tuesday of every month except May, June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. J. L. Scales, Medical Arts Bldg., Shreveport, La.
Secretary-Treasurer: Dr. W. L. Atkins, 505 Medical Bldg., Shreveport, La.
Place: 1240 Texas Ave. Time: 7:30 p. m., first Monday of each month from October to June.

Spokane Academy of Ophthalmology and Oto-Laryngology

President: Dr. Paul A. Remington, Old National Bank Bldg., Spokane, Wash.
Secretary: Dr. Louis A. Parsell, Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. M. G. Brown, 713 E. Genesee St., Syracuse, N. Y.
Secretary-Treasurer: Dr. A. Harry Rubenstein, Medical Arts Bldg., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

Tulsa Academy of Ophthalmology and Otolaryngology

President: Dr. Roy Dunlap, 108 W. Sixth St., Tulsa, Okla.
Secretary-Treasurer: Dr. Marvin D. Henley, 108 W. Sixth St., Tulsa, Okla.
Place: Medical Arts Bldg. Time: Monthly.